AVIATION WEEK

JULY 13, 1953

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Gun platform?

SURE. That's all a fighter plane is—a gun platform. But up here you forget. Up at thirty thousand feet, the sun is white on anvil wisps of thunderheads. You move the stick over. The horizon rolls and you look up at the sea.

To the engineers, she's the Cougar—complex requirements solved by design. She is so many pounds of thrust and weight, lift and drag. She is thousands of parts and hours of work by hundreds of men and machines, hours of inventiveness and investigation. To some, she is requests to do more, carry more, fly faster, which somehow she does.

A gun platform? The best, and more. So much more, you wonder sometimes how men with only knowledge and experience, with only their hands and their machines could ever have created her.

Make your career in Naval Aviation.

GRUMMAN AIRCRAFT ENGINEERING CORPORATION

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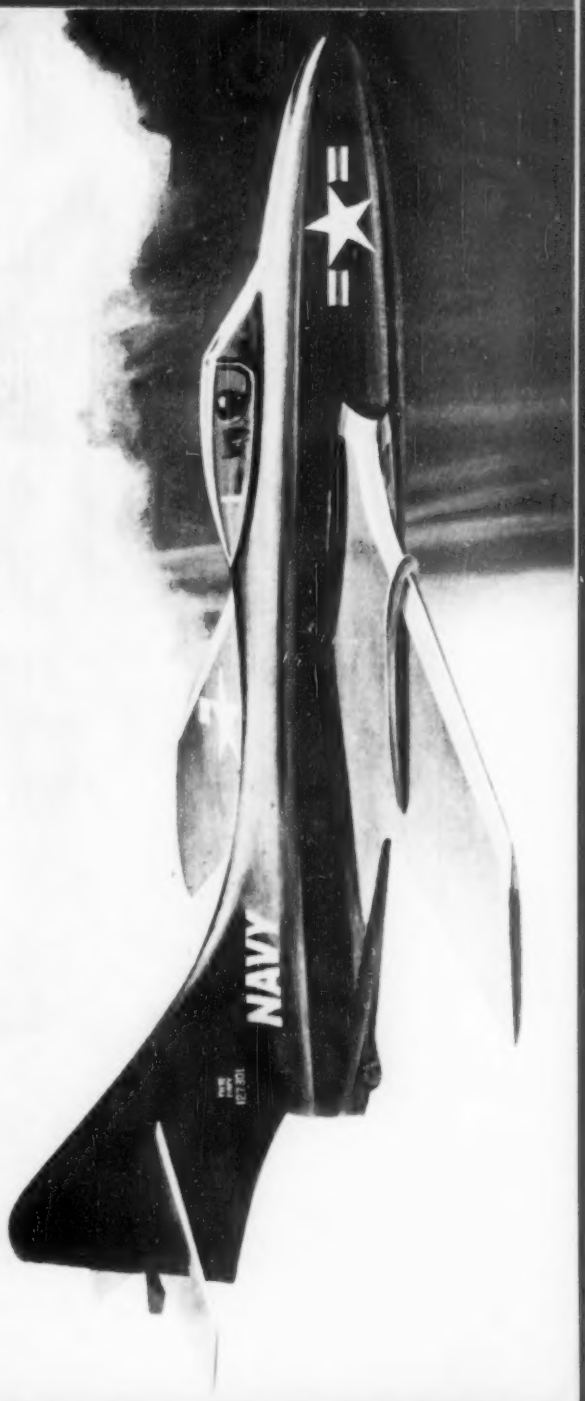
DESIGNERS AND BUILDERS ALSO OF THE PANTHER JET FIGHTER, THE ALBATROSS TRIPHIBIAN, AND THE S2F-1 SUB-KILLER



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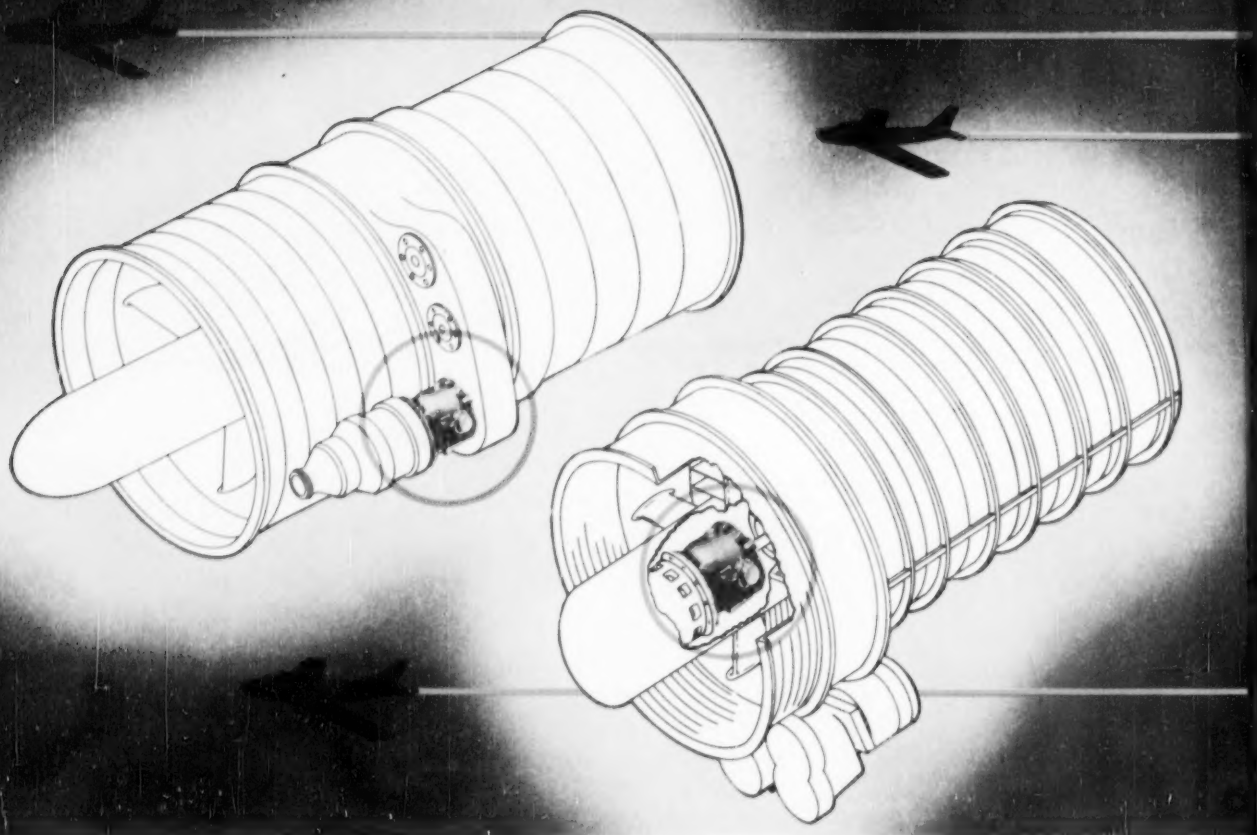
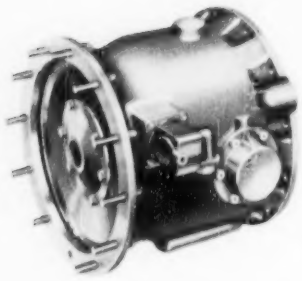


Sandwich-Type Constant Speed Drive . . . ideal for waist gear box or nose cone installation



• Built with a flange at either end, the Sandwich-Type Drive is mounted to an engine gear box by the input flange. An alternator mounts directly to the output flange. With the output flange carrying the weight of the alternator, auxiliary supports are unnecessary. This makes the Sandwich-Type Drive especially adaptable to waist gear box or nose cone installations. The diameter and length are kept to a minimum, resulting in an extremely compact, weight-saving unit. Available in either axial-piston or radial-piston types. Both mount in the same manner. Investigate the possible application of this or one of Sundstrand's other Drives to your constant speed problem. Come to Sundstrand for *reliable* research, *expert* engineering, and *precision* production.

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The Sandwich-Type Drive uses the engine lube system for performing the functions of charging, scavenging, and lubrication. It can be supplied with its own independent system for these functions, if desired. All Sundstrand Drives maintain constant speed within ± ¼ of 1% during normal operating conditions. Each unit designed for highest efficiency even at extremely high altitudes.

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B.F.Goodrich

Lets pilots breathe easy 8 miles high

THE CANOPY BUBBLES on fast military airplanes had to be safely pressurized at altitudes of 8 miles or higher. But the ordinary inflatable seals between bubble and cockpit couldn't take the effects of high pressures on the inside, low pressures on the outside.

B. F. Goodrich engineers, called in by the customer, studied the problem. A really effective seal, they believed, should stretch very little or not at all. Less stretch would mean lower pressure, less strain. They worked out a seal with a solid base fastened to the rim of the cockpit and a rubberized fabric covering that simply *lifts* when inflated to form the sealing tube. When this tube inflates, it works like blowing up a paper bag—low pressure brings it to its full expansion and doesn't stretch the fabric enough to notice it. Dangerous stretching of tube wall (like blowing up a toy balloon) is eliminated.

The new seal works almost instantly. Even at minus 65° it inflates with less pressure than old-type seals needed at room temperature. There are other advantages. It resists wear and damage better than ordinary seals. It fits complex curves better. It seals and unseals faster. Sliding wear and scuffing are minimized.

The new B. F. Goodrich seal is now used on more than a dozen makes of planes, including these Navy and Air Force jets: McDonnell Banshee, top left; Northrop Scorpion, top right; Chance Vought Cutlass, bottom left; North American Sabre, bottom right. *The B. F. Goodrich Company, Aeronautical Division.*

B.F.Goodrich
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Dept. A-54, Akron 18, Ohio

- ☐ Have nearest BFG representative call with more information about the B. F. Goodrich inflatable strip seal.
- ☐ Send free folder that explains how seal works, shows cross-sections, gives typical installation.

Name
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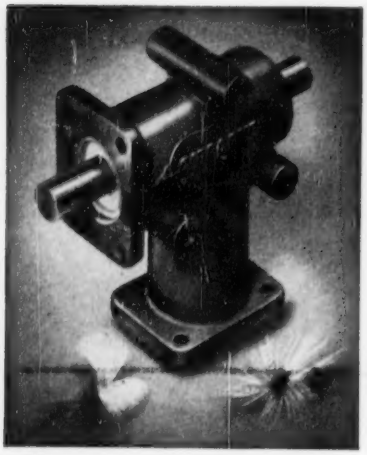
RIGHT ANGLE DRIVE?



Perhaps the compact design of ANGLgears—they fit into the palm of your hand—will solve your problem. And these standardized right angle bevel gear drives have the capacity of units many times their size. Model R-300 is rated at 1/3 hp at 1800 rpm —Model R-320 at 1 hp. Both models have hardened gears and ball bearings, are lubricated for life. Both can be supplied with either 2 or 3-way extensions too.

ANGLgears are described fully in the I.A.S. Aeronautical Engineering Catalog. We suggest you refer to this publication for complete data.

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Table of Contents on Page 8 | **47,373 copies of this issue printed**

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Now Fafnir Control Bearings have load ratings that reflect actual operating conditions. Re-evaluation of load ratings by a new and improved formula greatly extends the field of application for this first and leading "family" of vital aircraft control bearings.

If you are a veteran aircraft designer, you'll recognize this advance as one of several made since the "K Series" was introduced in 1933. Only a few years ago, it was redesigned to take the famous Fafnir patented Plya-Seals.

The creation of new aircraft bearings at Fafnir is never regarded as the end of a job . . . just the beginning. Through continuous research, experimentation and collaboration with aircraft design engineers, Fafnir keeps "on the ball" with bearing developments and improvements. That's why *Fafnir continues to get and to welcome "tomorrow's jobs" today.* The Fafnir Bearing Company, New Britain, Conn.

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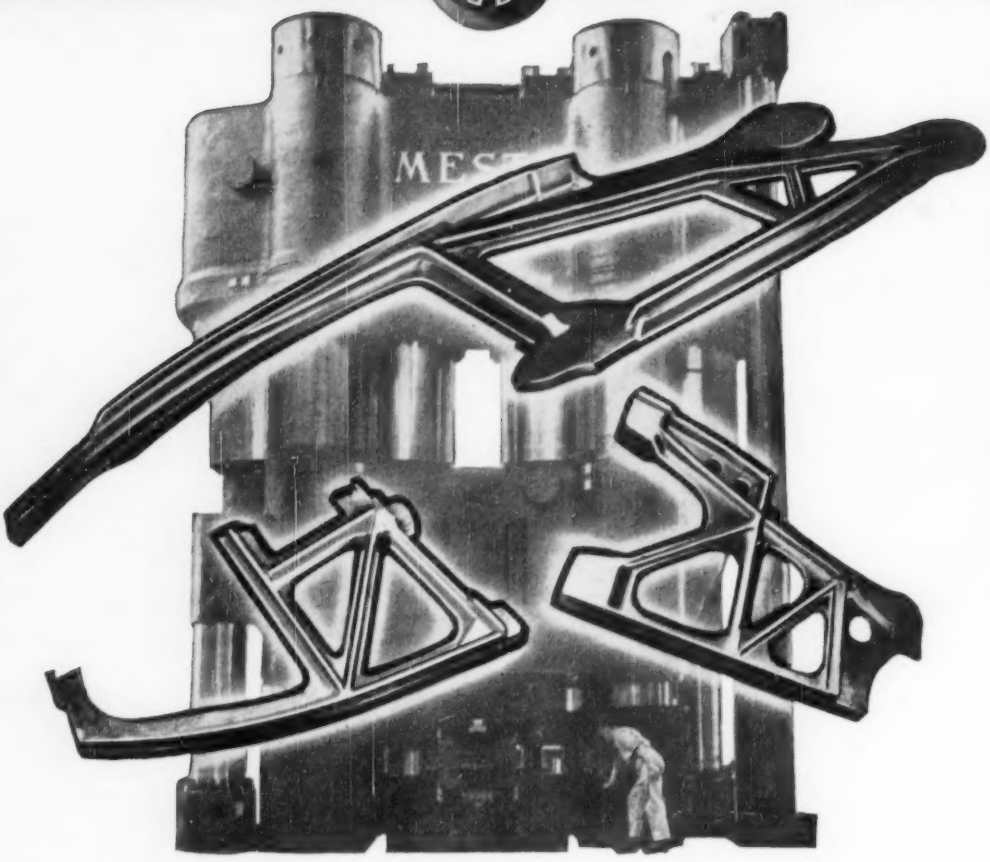

Greater Size and Speed in Aircraft have created engineering problems, the solution of which has required larger and larger forgings of high-strength aluminum alloy. *Examples* shown above are forged structural members used in a modern military bomber, the largest more than seven feet over all. These are forged on an 18,000-ton press, the biggest ever built in this country.

Wyman-Gordon Experience—the most extensive in the industry—is keeping abreast of new forging demands involving the use of Steel, Aluminum, Magnesium, High Density Alloys and Titanium.

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Standard of the Industry for More than Sixty-five Years

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FORGINGS OF ALUMINUM • MAGNESIUM • STEEL

WORCESTER, MASSACHUSETTS

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NEWS DIGEST

Domestic

Bell X-1A now carries fuel enough for four and a half minutes of wide-open operation, nearly twice that of the X-1, Maj. Charles E. Yeager told an ASME meeting in Los Angeles last week. Yeager, first man to crack the sonic barrier, hinted X-1A would exceed X-1's Mach 1.5 performance.

C-124 Globemasters will undergo five modifications in generator area, following study headed by Maj. Gen. Victor E. Bertrandias, USAF Deputy Inspector General, of crash that killed 129 in Japan June 18. Investigation showed crash followed failure of generator driveshaft of left outboard engine (see story, p. 22). Modifications are: separation of fuel pump and generator vent lines; shielding of generators and alternators from fuel spillage; blast tubes for additional generator cooling; incased tightening of mounting belts that secure generators to engines; cockpit indicator to show generator overheating.

USAF Gen. Lauris Norstad is new Air Deputy to the Supreme Commander of Supreme Headquarters Allied Powers, Europe, a shift that increased centralized control of western air units. Norstad's former post, Central European Air Commander, will be taken over in the reorganized SHAPE command structure by Air Chief Marshal Sir Basil Embry of Britain.

All-electronic simulator for B-52 jet bombers will be designed and built by Curtiss-Wright Corp.'s Electronic Div. at Carlstadt, N. J., under a contract awarded by USAF, Roy T. Hurley, corporation chairman and president, announced last week.

"Sick strike" was staged by more than 170 Trans World Airlines mechanics, cargo handlers and commissary employes for 24 hr. July 4 at New York's Idlewild International, La Guardia and Newark Airports, TWA reports. Airline officials say the wave of absenteeism grew out of efforts by TWA, four other major air carriers and International Assn. of Machinists (AFL), representing most of the workers, to negotiate a new contract.

Octave Chanute Award for 1953 will be presented by IAS this week to William B. Bridgeman, Douglas Aircraft engineering test pilot, for "outstanding contributions to the knowledge of supersonics." Thurman H. Bane Award will be given to Benjamin F. Greene, Jr., ARDC Cambridge Research Center, for the development of an electronic system for airport traffic control.

YB-52 Passes Year of Tests

Eight-jet Boeing YB-52 Stratofortress, with more than a year of flight testing on its log, poses for picture over the Pacific Northwest. The big bomber's Pratt & Whitney Aircraft J57 engine, in the 10,000-lb.-thrust class, is proving itself one of the finest turbojets yet developed, Boeing engineers report, pointing to the powerplant's quick rate of acceleration. Boeing's new 707 jet transport will be fitted with four J57s.

Four B-29s piloted by RAF crews landed last week at MATS' Dover, Del., base, the first group of approximately 100 Superfortresses that Britain is returning to USAF. The bombers were loaned to RAF three years ago under the Mutual Defense Assistance Program.

Final F3D Skyknights and AD-4 Skyraiders produced for Navy by Douglas Aircraft Corp. have rolled off the assembly lines at the El Segundo (Calif.) Div., making way for output of new F4Ds, AD-5s and 6s.

Flying Tiger Lines' $15-million annual contract for MATS flights on the Pacific airlift has been renewed despite cutbacks in the California-Tokyo military route. The agreement carries a 30-day cancelation clause.

Air transport contract has been awarded Transocean Air Lines by American President Lines to fly 740 merchant seamen to U. S. ships in the Far East during July and August and return old crews from Tokyo to Oakland, Calif.

Lightplane shipments by seven U. S. companies last month added up to 338 one- to 10-place utility and executive aircraft with a total value of $3,435,000, Aircraft Industries Assn. reports. Companies included in the report: Aero Design, Beech, Callair, Cessna, Mooney, Piper and Taylorcraft.

Financial

Southwest Airways reports a net profit of $86,714 for 1952 from all-time high gross operating revenues of $2,883,069.

Western Air Lines has declared its third 1953 dividend: 15 cents per share payable Aug. 15.

International

Supermarine Swift, British jet fighter, set an official London-Paris speed record last week, flying the 216-mi. course in 19 min. 28 sec. at an average speed of 668.8 mph. The new mark clipped 1 min. 19.4 sec. from the previous record set four years ago.

Piasecki Helicopter Corp., Morton, Pa., has formed a wholly owned Canadian subsidiary, Piasecki Helicopter Co. of Canada, Ltd.

Curtiss-Wright Corp., Wood-Ridge, N. J., has formed a wholly owned subsidiary in Amsterdam, Holland, to develop use and servicing of the company's products in Europe. The new division, the firm's tenth, is called Curtiss-Wright Europa, N. V.

GUNS... on the double!

Chase Assault Transports—the only planes capable of delivering heavy equipment to forward combat areas by ***landing*** in small, unprepared fields.

Gruelling Air Force-Army tests have proved this advanced engineering development which replaces—as the primary means of delivery—costly, uncertain techniques developed for interim use.

No time or weight penalty, no loss from chute malfunction or impact damage. Guns and vehicles are driven out of assault transports, intact, clean and ready for immediate service.

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The Aviation Week

July 13, 1953

Headline News

AF Budget Due for Showdown..... 12
Detroit Labor Battles on Kaiser..... 14
Temco to Stress Own Designs..... 14
New ARDC Chiefs: Putt, McCormack.. 14
Trained Pilot Shortage to Hit AF..... 15
Latest Allied Jets at Paris Show..... 16
Smith New Navy Air Secretary..... 18
Crash Barriers Save AF Jets..... 21
Solar Delivers Generator for C-124..... 22
Army Orders New S-58 Copters..... 25

•

Production Engineering

Making Jet Buckets and Blades Better. 29
ASME Looks at Bottlenecks..... 35
Convair Flying Boat Test Dock..... 43

•

Financial

Airline Investors Want Dividends..... 44

•

Avionics

NAA Builds Expert Avionics Team... 48

•

Equipment

Air Units Can Live Out of Boxes..... 55

•

Aviation Safety

BOAC Comet Crash Near Calcutta..... 63

•

Air Transport

Route Case Outlook: Decision in '54... 83
Counterclaims Fly at Pacific Hearing.. 84
Nonsked Wins Delay of Hearings..... 84
Operators Back C-46 Safety Plan..... 85
MATS Reports Civil Korea Airlift..... 88
Wiggins Loses Air Certificate..... 88

•

Departments

News Digest..... 7
Picture Page..... 9
Who's Where..... 11
Industry Observer..... 11
Navy Contracts..... 40
USAF Contracts..... 40
Filter Center..... 52
Off the Line..... 58
New Aviation Products..... 58
Also on the Market..... 61
CAB Orders..... 88
Shortlines..... 96
Aviation Calendar..... 96
Letters..... 98

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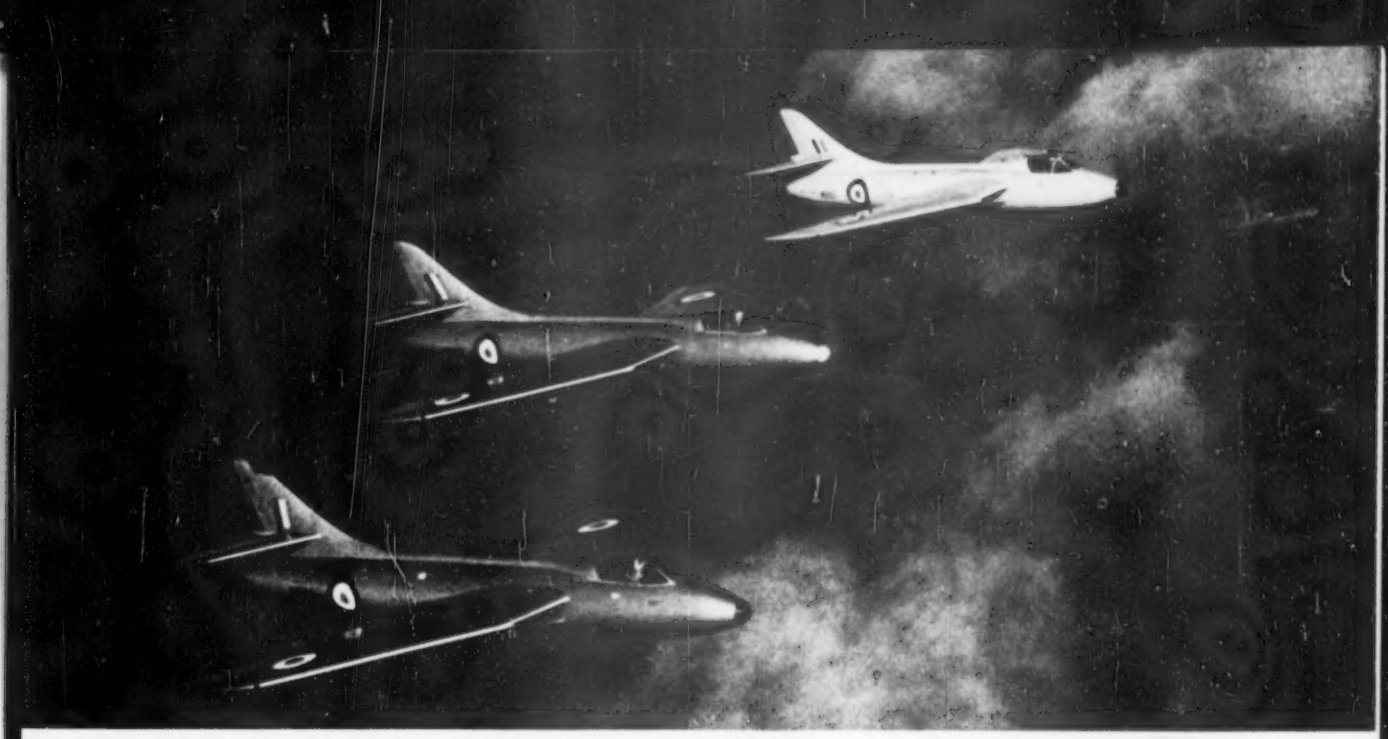


HUNTERS ON THE WING—This first picture of a formation of Hawker Hunter interceptors shows three different models of the craft. From top to bottom: prototype F.1 with Rolls-Royce Avon, prototype F.2 with Armstrong Siddeley Sapphire, and the first production F.1 (Rolls-Royce Avon).

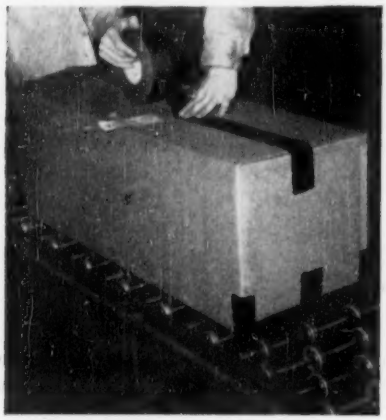
Aviation News In Pictures

NEW MOONEY "WEE SCOTSMAN"—Plaid tail of Scotchlite reflective material keynotes the 1953 single-seat Mooney 18. Color scheme makes the plane more readily visible when light is poor. The tiny Mooney "Wee Scotsman" Model 18 is powered by a 65-hp. Lycoming and can carry a pilot and 75 lb. baggage 400 mi. in three hours with 175-mi. fuel reserve remaining. The Dallas company is working on a four-place plane, the Model 20, with 145 hp.

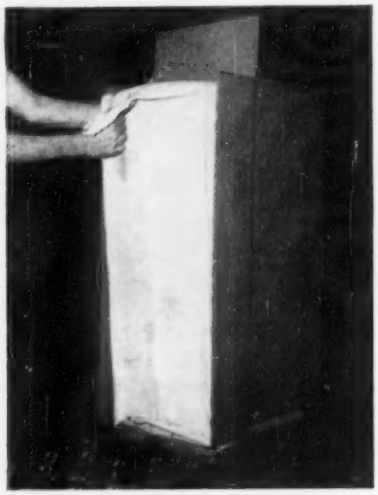
GHTPLANE HYDRO-SKIS—Convair OY is fitted with All American gineering Co.'s hydro-ski landing gear incorporating wheels. Gear permits ll plane to operate from grass, mud flats, seaplane ramps and beaches. e Wilmington, Del., firm developed this planing-surface installation under y contract to evaluate novel landing gear's characteristics.

FRENCH FLY CONVERTIPLANE—Here is new Sncaso S.O. 1310 Farfadet convertiplane undergoing flight tests. Craft has 360-hp. Turbomeca Artouste turboprop engine turning propeller in nose and a 360-hp. Turbomeca Arrius that powers rotor. Rotor is placed in autorotation for highspeed forward flight.

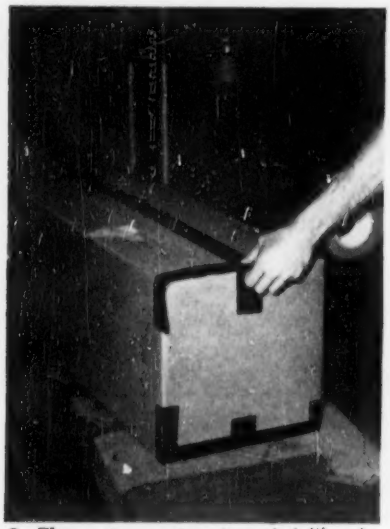
How Stewart-Warner makes ONE TAPE do the WORK OF TWO



1. A packaged South Wind heater for the Army is sealed with waterproof Polyken Tape No. 215.



2. The carton is then bagged in an aluminum foil-lined sack from which the air is removed. This bag is placed in a slightly larger carton.



3. The outer carton is sealed like the inner one with Polyken Tape No. 215.

4. Spare parts get the same government-approved treatment.

Polyken Industrial Tape Cuts Costs and Improves Gov't Spec. Packaging of South Wind Heaters

Stewart-Warner Corp. formerly used *two* different tapes to seal inner and outer cartons containing South Wind automotive and aircraft heaters for military and civilian use.

Then they switched to waterproof Polyken Tape No. 215 for *both* jobs. A follow-up check by packaging engineers revealed that the cartons were being sealed more securely, packaging costs had been reduced and the possibility of workers using the wrong tape had been eliminated.

Polyken No. 215, ideally suited for this Stewart-Warner job, is economical, waterproof, and conforms to Government Specifications JAN-P-127, Type 1 Grade B.

More than 100 other Polyken pressure-sensitive tapes are at your service, all tailor-made to save you time, money and effort. Send in coupon for free tape samples and booklet.

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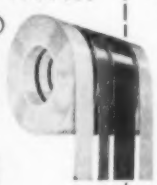

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Division of The Kendall Company

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222 West Adams St., Chicago 6, Illinois

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Company _____

Street Address _____

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WHO'S WHERE

In the Front Office

J. Carlton Ward, Jr., former president of Fairchild Engine & Airplane Corp. and onetime vice president-general manager of Pratt & Whitney Aircraft Div., United Aircraft Corp., has been elected president of Vitro Corp. of America, New York.

Maj. Gen. Frank A. Heileman (USA Ret.), former Army Chief of Transportation, has been named to the board of directors of Hiller Helicopters, Palo Alto, Calif.

Stanley Gewirtz is new assistant to the president of Air Transport Assn., Washington, D. C.

Capt. C. H. Schildhauer (USN Ret.) has been appointed assistant to the president of Air Carrier Service Corp., Washington, D. C.

Changes

John Hodgson has been named assistant to the vice president-flight operations of United Air Lines.

Brig. J. Clemow is new head of guided weapon development at Fairey Aviation Co.'s Research and Armament Development Div., London.

James H. Wiegand, authority on double-base solid propellants for rockets and guided missiles, has been appointed assistant chairman of Southwest Research Institute's department of chemistry and chemical engineering, San Antonio, Tex.

Claude R. Turner has been promoted to chief pilot, Pacific Div., Transocean Air Lines.

Arthur Robertson has joined Longren Aircraft Co., Torrance, Calif., as general manager.

Frederick G. Hull is new district operations manager for Capital Airlines at Rochester, N. Y.

Walter N. Connors has been appointed industrial relations administrator of Kellett Aircraft Corp., Camden, N. J.

Lou S. Gearhart has been named advertising director of United Aircraft Products, Dayton.

Stanley C. Hellman has been promoted to assistant director of contract administration for North American Aviation, Los Angeles.

Harold M. Bauer is new coordinator of contract operations of Flying Tiger Line in the Pacific airlift, succeeding **A. J. Jansen**, who resigned.

Luigi M. Crocco, jet propulsion and gas dynamics authority, and **Prof. Seymour M. Bogdonoff,** design and operations specialist in subsonic and supersonic research apparatus, have been appointed to the permanent faculty of Princeton University's department of aeronautical engineering.

Honors and Elections

Gen. E. R. Quesada (USAF Ret.), vice president of Olin Industries, has been named to the executive committee of the Flight Safety Foundation.

INDUSTRY OBSERVER

► Watch for an increasing amount of aircraft and engine spares contracts to be placed in Europe by U. S. firms for the support of NATO aircraft. In addition to the large Republic and Allison orders already placed in France and Italy for F-84 support, Wright is expected to order Sapphire (J65) spares from Armstrong Siddeley Motors for the F-84F program.

► **Hufford has sold 58 of its presses in England to date with all but one absorbed by the British aircraft industry. Hufford presses sold abroad range from a 17-tonner, being built in England under license, to a 200-tonner being used at Vickers-Armstrongs' Weybridge plant for production of the Valiant four-jet bomber.**

► Production models of the Gloster Javelin delta-wing, all-weather fighter will have increased wing area. Leading edge of the delta has been extended slightly as it tapers towards the wingtip.

► **Watch for Short Brothers to test a long-range patrol bomber incorporating boundary-layer control devices. The firm's chief designer, David Keith Lucas, recently gave listeners the following clue on the Short S.B. 6 in a recent lecture: "The thicker sections possible with boundary-layer suction make the idea more practical and it becomes very attractive for long-range, lowspeed aircraft which require endurance as opposed to range, as, for example, Coastal Command aircraft engaged in anti-submarine patrol."**

► Some observers saw a recent event in Britain as an example of how thin a disguise U. S. off-shore plane buying can be for direct aid. The first of 107 Hawker Sea Hawk naval jet fighters bought by the U. S. for $13 million under the off-shore program were delivered by Armstrong Whitworth, the manufacturer, to the U. S. Navy at a Coventry ceremony. In the ceremony the U. S. Navy then handed the aircraft to the British Navy. It is expected that some Hawker Hunters being bought by the U. S. under off-shore procurement will similarly find their way to the Royal Air Force.

► **Handley Page is promoting its H.P.R. 3 design for a DC-3 feeder-liner replacement but so far has had no takers. No decision has been made yet to build a prototype.**

► Rolls-Royce R.A. 7 Avon, which powers the Swift and Hunter fighters, has passed a type test at 10,000 lb. thrust without afterburning. The official R.A. 7 rating is 7,200 lb. dry and 9,000 lb. with afterburning.

► **Hawker Aircraft has scrapped plans for a delta-wing fighter and will continue to develop the basic Hunter design with more sweepback and more power as previously reported in Aviation Week.**

► Curtiss-Wright Corp. has formed a special team of expediters to speed production of the J65 Sapphire turbojet. Team members are identified by special oversized badges and have the power to roam through the Wright shop taking priority on machines and tools for J65 production from other production items.

► **Sncase, French licensee of Sikorsky on the S-55 10-place helicopter, has named its product the Elephant Joyeux, "Joyful Elephant." Ten "Joyful Elephants" have been ordered by Air France and the French Air Ministry.**

► Latest interest in the de Havilland D.H. 110, twin-Avon-powered, twin-boom fighter that crashed at the 1952 SBAC Farnborough show comes from the British Navy. Second D.H. 110 prototype is now being used by the Ministry of Supply as a highspeed research aircraft.

► **CAA has developed a fire-resistant paint to protect aircraft oil tanks. First applications have been made on airline Constellations and USAF F-86 Sabre fighters.**

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Evolution of USAF's Fiscal 1954 Budget

The following table outlines the 10 steps in development of Air Force's fiscal 1954 budget from the first USAF request for $22.3 billion to $11 billion recommended by the House of Representatives.

The first seven columns contemplate a 133-wing Air Force by mid-1954, end of the new fiscal year. They disclose that estimates to achieve this goal varied from USAF's first recommendation to the revised $15.2 billion submitted by AF on Apr. 7, a $7.1-billion cut that resulted from studies initiated by former Secretary for Air Thomas Finletter. The $11.7 billion recommended by Secretary of Defense Charles E. Wilson contemplates a 114-wing USAF by mid-1954, and the $13.1 billion asked by Gen. Hoyt S. Vandenberg shortly before his retirement as Air Force Chief of Staff contemplates a 120-wing force by mid-1954.

Selected Items	(1) Original USAF recommendation (Fall 1952)	(2) Defense Dept. staff recommendation	(3) USAF revised recommendation	(4) Defense Dept. recommendation	(5) Budget Bureau recommendation	(6) Truman recommendation (Jan. 9)	(7) USAF recommendation, as revised (Apr. (7)	(8) Wilson recommendation (June 15)	(9) Vandenberg recommendation (June 15)	(10) House recommendation (July 3)
					(In billions)					
Aircraft and related procurement	$7.0	$6.0	$8.2	$6.9	$6.2	$6.6	$5.3	$3.5	$3.8	$3.5
Base construction	.99	.67	.86	.70	.70	.70	.66	.40	.66	(1)
Operations	4.6	3.9	4.6	4.3	4.2	4.2	4.2	3.2	3.8	3.0
Research and development	.58	.47	.61	.55	.51	.54	.54	.47	.47	.44
Total budget (2)	$22.3	$15.6	$19.6	$17.3	$16.2	$16.8	$15.2	$11.7	$13.2	$11.0 (3)

(1) This item will be considered later.
(2) Total includes these unlisted items: major procurement other than aircraft, military personnel requirement, reserve personnel requirement, Air National Guard, contingencies.
(3) Exclusive of money for base construction.

AF Budget Nears Showdown in Congress

- **Senate Military Appropriations Subcommittee recalls Vandenberg, Wilson for final testimony on cuts.**
- **House debate centers on Eisenhower's support of the reduced funds and Twining's stand in the fight.**

By Katherine Johnsen

More odds were stacked against Air Force proponents fighting to increase USAF's fiscal 1954 funds as Congress rushed to complete action, already overdue, on the defense budget for the new year that opened July 1.

There were these developments:

• **President Eisenhower** released a letter stating that the pared budget "represents my own views and bears my personal endorsement in all particulars."

• **Gen. Hoyt S. Vandenberg,** recently retired USAF Chief of Staff, and Defense Secretary Charles E. Wilson—the two key contenders in the USAF budget fight—were asked by chairman Homer Ferguson to make a final appearance before the Senate Military Appropriations Subcommittee.

In testimony before the subcommittee last month, Vandenberg launched his attack on Wilson's $5-billion slash of the $16.8-billion AF budget submitted by former President Truman. In a letter to the subcommittee, he later requested that $1.4 billion of the cut be restored to salvage the Air Force buildup to 143 wings—already disrupted, he said, by Wilson's restrictions.

The request for reappearance of Wilson and Vandenberg was made by Sen. John McClellan, wavering in his original support for a bigger USAF budget, who said he wanted answers to "doubts" raised by conflicting Vandenberg and Wilson testimony.

• **The House,** by a sweeping 161-to-230 vote, rejected a proposal to add $1.17 billion recommended by Vandenberg to the USAF budget. (Vandenberg's request for an additional $260 million for base construction was not considered, because this comes up in a separate defense public works measure.)

The package $1.17-billion amendment pushed by Rep. George Mahon, top Democrat on the Military Appropriations Subcommittee, would add: $353 million for aircraft and related procurement; $50 million for electronics and other major procurement; $600 million for maintenance and operations; and $172 million for military personnel.

In addition to Mahon, Reps. Sam Yorty, former AF officer who called for Wilson's resignation because of the Air Force slash, Paul Kilday and Minority Whip John McCormack carried the ball for the additional USAF money. Influential Rep. Carl Vinson, top Democrat on the Armed Services Committee, voted for it but didn't actively participate in the controversy.

The vote was split down party lines. Only five Republicans supported a higher USAF budget: Reps. Shepard Crumpacker and Charles Nelson (both Air Force officers during World War II), Carl Hinshaw, Walter Judd and Edith Nourse Rogers. Thirty-three Democrats, mostly from the South, joined 196 Republicans in opposing it.

• **The USAF defeat** was compounded when the House later voted unanimously to confirm the $11-billion

budget recommended by its appropriations committee. This was $240 million lower than Wilson's recommendation.

No effort was made to restore this cut that sliced: $150 million from maintenance and operations; $35 million from research and development; $30 million from military personnel; and $25 million from major procurement other than aircraft.

Rep. Jacob Javits, urging the House to go down the line with President Eisenhower's recommendations on defense money, abandoned an attempt to have the research and development cut restored after the House killed his amendment to reinstate similar Army funds slashed by the committee.

▶ **Floor Fight**—Meanwhile, former Secretary of the Air Force, Sen. Stuart Symington, took the Senate floor for a point-by-point defense of the USAF against an attack by the House Appropriations Committee Chairman, John Taber. Some of the interchange:

Taber: Vandenberg has taken a "ridiculous attitude"—his statement, with Wilson's analysis of it, shows "what kind of sabotage Wilson is up against from Vandenberg and the crew that is trying to cover up their own iniquities by making false statements about what the situation is."

Symington: "A great officer graduates from West Point. He serves his country for over 30 years. He becomes the head of Gen. Eisenhower's Tactical Air Force in Europe. He is highly decorated for personal gallantry in action. His reward, as he now leaves his country's service, is to be accused of making false statements, of being a 'saboteur' against his country's interest."

Taber: "The only planes removed from the program to be contracted for were transport planes and planes that were used for training."

Symington: "Two hundred B-47 bombers of the newest type were eliminated. . . . In addition, assault transports (six wings) are consistently characterized by the Defense Department as non-combat aircraft.

"This effort to classify assault transports as non-combat planes would be bitterly argued against by those paratroopers who jumped over Normandy and Arnhem and also by the pilots who flew those jumpers in."

Symington said Taber was given "misinformation" by the Assistant Secretary of Defense (Comptroller), W. J. McNeil. The former AF Secretary stated:

"Much, if not most, of the information about a service comes to the appropriations committees of the Congress from the Office of the Comptroller, and for years the head of that office has spoken and written against the Air Force.

"The Comptroller's Office told me that evidence of waste would be used against the Air Force if this reduction program was resisted in the Congress or anywhere else. Recent events prove only too conclusively that this threat was no idle boast.

"But up until now, no one had accused the Chief of Staff of the Air Force and the Air Staff of being iniquitous saboteurs because they answered, in good conscience, questions put to them by the Congress."

▶ **House Debate**—These were the main points dwelt upon in the House debate on USAF's budget:

• Is the President in favor of the slash in USAF funds?

Leaders of the fight for USAF stood firm by their contention that "the money men" made up the defense budget and that the President simply "went along" with it, even in the face of a strongly worded letter from Eisenhower to Rep. Errett Scrivner. Stating that the budget represents his own views, the President wrote:

"The force levels—Army, Navy, Air Force, and Marine Corps—and the total sums requested for expenditure and obligation have been carefully considered by the National Security Council in meetings over which I have presided.

"In addition, and during the same three-month period in which the budget was evolved under the aegis of the council, I met frequently with the Secretary of Defense and his deputy, discussing in detail fundamental defense problems, including budgetary matters and force goals."

The President, for the first time specifically endorsing the USAF cutback, observed:

"There is . . . the ever-present struggle, with which all of us are familiar, of service partisans for a larger proportion of the defense dollar—an issue that is never resolved to the full satisfaction of any service.

"These attitudes, among others, find expression in the current effort to pile dollars upon unexpended dollars in Air Force appropriations. Actually, the major portion of the Air Force reduction is simply application of rationality to requests for new appropriations so that previous over-funding of Air Force requirements can be eliminated. Through better programming and organization . . . we will attain more combat air power more swiftly than would otherwise have been likely of achievement."

• Is USAF's Chief of Staff, Gen. Nathan Twining, in favor of the Wilson program?

The opposition to the USAF slash claimed Twining was on their side. They supported their case by pointing to the general's testimony before the Senate Armed Services Committee when he appeared for confirmation. At that time he said he thought a 143-wing USAF "necessary" and said he felt the "fiscal manipulations" of the Defense Department would delay the building of 143 wings.

But Wilson's supporters, claiming Twining for their side, reiterated his later testimony: "What the force should be, I could not say. Maybe it is more than 143 wings and maybe it is less. But I do feel it is time to take a good look at it."

• Should Congress make money available so the Administration can promptly launch a 143-wing buildup if the new Joint Chiefs of Staff re-affirms this as the force goal this fall?

The 143-wing advocates argued that this should be done. They pointed out that Congress will not be in session

PRODUCTION STARFIRES PACK DOUBLE WALLOP

New Lockheed F-94C Starfire all-weather fighters are seen at company's Van Nuys plant prior to delivery to USAF interceptor squadrons. The dark-colored auxiliary 2.75-in.-rocket pods protruding from the leading edges of the planes wings carry 12 missiles each. In addition there are 24 more rockets concealed in a ring around the fuselage nose, just behind the pointed radome. The stovepipe-like gear jutting upward behind the planes' tails are silencers to muffle roar of Starfire's PWA J48 during ground tests.

and, if the new JCS re-affirms the 143-wing force level, the money should be on hand to move forward with it promptly.

Rep. Paul Kilday commented: "Let us make the funds available, and if they do not want to use them, they do not have to. But if they do not use them and disaster comes it will be clear and plain to all who brought it about."

But the opposition argued that this isn't necessary since the defense budget is exempted from the law which requires departments and agencies to allocate funds for a full year's operation.

In other words, the President could permit Defense Department to go full-steam on spending and obligating this fall and request a deficiency appropriation next January for the remainder of the year.

• Is carrier aviation being substituted for USAF in the strategic role?

Pointing out that Wilson's program cuts out five Strategic Air Command wings but allows construction of a third Forrestal-class carrier, Rep. Yorty raised the question as to whether carrier aviation is to replace the Strategic Air Command.

But there was no fight to kill funds for the carrier, and Yorty pointed out that he supported construction of the second carrier last year—indicating that USAF proponents do not now want to open warfare on the Navy.

Yorty commented: "If the Air Force is going to have to compete for the same reduced funds, you are going to have to set up some priorities and evaluate the Forrestal carrier and carrier task forces against the five strategic air wings and the other wings which you are losing. I do not think that has been done."

Detroit Labor Battles Pentagon on Kaiser

Kaiser Motors Corp. and Chase Aircraft Co. officials awaited word at the end of last week of the outcome of Air Force Secretary Harold Talbott's conference with Michigan congressmen and union leaders of the Detroit area.

Talbott set the second Pentagon conference at the insistence of Detroit unionists. They represent the 10,000 union members of Kaiser's Willow Run, Mich., plant who stand to lose because of Air Force's cancelation of Kaiser's C-119 contract. Union officials strongly defended the production record of workers in the Detroit automotive industry.

While hometown newspapers kept needling their Washington correspondents for stories to keep the Kaiser story hot in Michigan, Air Force spokesmen maintained the cut had been made and it would probably stay cut.

Here is where the two affected manufacturers stood last week:

• Kaiser is now phasing out C-119 production of 71 planes which it is supposed to finish within three months. Nearly 6,000 employes have been furloughed at the Willow Run plant. The congressmen—Sens. Homer Ferguson, Charles E. Potter and Reps. George Meader and Charles G. Oakman—want Air Force to continue the Kaiser C-119 contract on a fixed-fee basis, in place of the original cost-plus-fixed-fee arrangement.

• Chase Aircraft is at a standstill on C-123 production since Air Force canceled its contract. The firm has laid off 1,000 workers and instructed its subcontractors to stop production on all C-123 components. Army Secretary Robert T. Stevens has notified Talbott that Army still wants the C-123 produced, but Air Force has not moved yet.

▶ Union Defense—Meantime, Emil Mazey, secretary-treasurer of the United Auto Workers, CIO, speaking for the Detroit industry, charged that "such delays and difficulties as have been experienced in aircraft production have been due more to Pentagon bungling, red tape and inefficiency than anything else."

"I believe," said Mazey, "that the present charges against the automobile workers (at Willow Run) are also an effort to raise a smoke-screen to conceal these inefficiencies and to head off a complete investigation of Air Force procurement policies. The nation would be better served by such an investigation than by anonymous slanders against the workers in the automobile industry in Detroit," he said.

"Statements purportedly from Air Force officials that Detroit workers are lazy and indifferent," said Mazey, "are a slander on the men and women who earned for Detroit the title, 'Arsenal of Democracy,' during World War II and who have made the American automobile industry the most productive and most profitable in the world."

"Air Force officials who made such statements are either deliberately misrepresenting the truth or else they are speaking out of gross stupidity," he charged.

Temco to Stress Own Plane Designs

Temco Aircraft Corp. will concentrate henceforth on developing military aircraft of its own design and subcontracting major assemblies for other manufacturers, Robert McCulloch, president of the Dallas firm has revealed.

The firm's chief executive says Temco will build at its own expense flying articles of one or more of the trainer and fighter designs it submitted to the Air Force and Navy. The company hopes thus to prove that the cost performance and lead times it had submitted were not too optimistic. Temco will also enter further trainer and combat plane competitions, McCulloch says.

The policy shift follows closely news of Navy's cancelation of the firm's prime contract to produce the McDonnell F3H-1 Demon jet fighter.

Temco built its growth primarily on subcontracting for major prime military aircraft contractors and overhaul and modification work, although it has also manufactured the two-place Swift lightplane, a design taken over from Globe Aircraft, and several years back designed the Temco T-35 Buckaroo piston engine trainer, a small number of which have been built.

Temco is still in the Demon fighter production picture, McCoulloch states. The firm will make subassemblies, totaling about 35% of the complete airframe, on contract from McDonnell Aircraft Corp. This will require at least 1,300 more workers at Dallas and 500 more at Garland, Tex., by Dec. 31. Approximately 1,000 workers were laid off at the two plants because of the F3H prime contract termination.

New ARDC Chiefs: Putt, McCormack

Maj. Gen. Donald L. Putt succeeds Lt. Gen. Earle E. Partridge as Commander of the Air Research and Development Command, U. S. Air Force. Putt has been Vice Commander of ARDC at Baltimore. Partridge becomes Deputy Chief of Staff for Operations at USAF Headquarters.

Commissioned a second lieutenant in the Signal Reserve in 1928, Putt has 17 years experience in various air research and development assignments. He is a 1928 graduate of Carnegie Institute of Technology with a bachelor of science degree in electrical engineering. He holds a master of science degree in aeronautical engineering from California Institute of Technology.

He served with the Air Force in Europe during World War II, returning in 1945 as Assistant Chief of Staff for Intelligence at Air Materiel Command, Wright-Patterson Field. In December 1946 he became Deputy Chief of the Engineering Division at Wright-Patterson.

Putt has also served as Director of Research and Development in the Office of the Deputy Chief of Staff for Materiel and as Assistant Deputy Chief of Staff for Development.

Maj. Gen. James McCormack, Jr., succeeds Putt as ARDC Vice Commander. Much of McCormack's recent experience has been in military applications of atomic energy.

Twining's 1954 Forecast:

Trained Pilot Shortage to Hit AF

New Air Force Chief says airmen are highly trained but underpaid technicians who hold edge on Reds.

Startling advances in today's swept-wing, supersonic jet aircraft tend to overshadow the strides being made by U.S. airmen, Gen. Nathan F. Twining, Air Force Chief of Staff, said last week.

In his first major speech since he became Chief of Staff, Twining told Mississippi's American Legion convention at Biloxi not to forget "the new airmen."

▶**The New Airman**—"Unlike the new airplanes, he shows no startling changes in design, he has no sweepback and no supersonic roar," the general said, "but he must be a new man nevertheless."

He differs from his World War II predecessor in that "he must now speak the language of geometry and calculus in addition to the language of arithmetic. He must be able to call on his knowledge of physics and chemistry in addition to his knowledge of mechanics, and he must have in addition to his understanding of electricity, a new background of experience in radar and other aspects of electronics."

In training such men, we are "producing against the future," the AF chief said. This new airman is "hard to find, hard to keep and hard to replace. He costs more in every respect; it takes more people to train him, and it takes much longer to train him. But the greatest cost of all would result from any failure to have him, to train him and to keep him trained."

Not a single item of our shiny new machinery of defense is "worth two cents," Twining told the Legionnaires, without sufficiently trained and experienced men to make it go at the instant we need it.

▶**U.S. Superiority**—He compared the Air Force accent on thorough training of each airman to the Communist method of sacrificing many planes and pilots in order to give combat training and experience to far greater numbers of men.

"They are rotating green pilots through the Yalu training grounds so rapidly most of them cannot match our fewer but more experienced pilots," he said. "But they are willing to lose as many as 15 in one day just for the valuable experience that the several hundred others who manage to get back to Manchuria will receive in these struggles."

The Air Force Chief revealed that F-86 pilots shot down 74 Communist MiGs without a single loss in air-to-air combat last month, "an unprecedented feat which may never be repeated." Everyone agrees that the superiority of the Air Force men made it possible, he said.

▶**Inadequate Pay**—In order to compete with the Red method of training the most pilots the cheapest way possible, "we must be willing to pay in money and effort though not in hundreds of lives and planes," the general explained.

Pointing up the expected shortage of adequately trained airmen, Twining predicted that "next year we will begin losing large numbers of veteran airmen of at least two or three years service, most of them with good backgrounds of technical training experience who began four-year enlistments shortly after the beginning of the Korean war.

He added that the most highly trained and highly skilled men have the lowest reenlistment rate of all. This is caused, he said, because of dissatisfaction with housing and living conditions in some places and inadequate pay when compared to private industry which bids for their services.

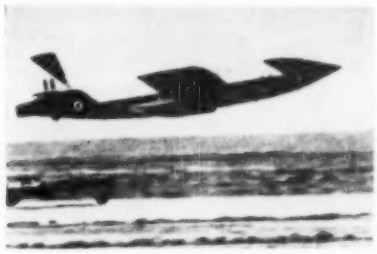
"As a result," he said, "the reenlistment rate for our most highly skilled people drops to as low as 15% and the Air Force has to find new men by the thousands each month and start the whole expensive process over again."

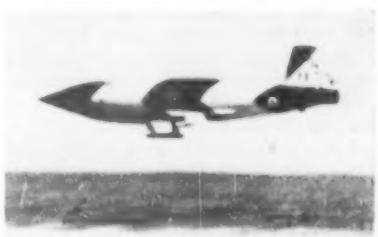
▶**Continual Change**—"While this goes on," according to the general, "we have to devote a large percentage of the resources of the Air Force just to replace the training investment we are constantly losing through failure to reenlist, to say nothing of the advanced training that must go on all the time to prepare all our people for new advances in equipment."

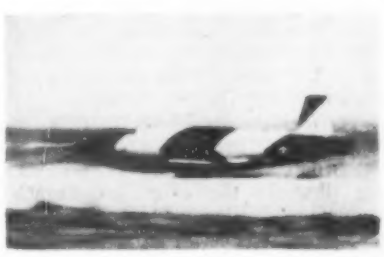
Another problem facing the Air Force is the continual advances being made in aircraft that require continual changes in training, he said. New gunsights on the F-86 Sabre jet make gunsights of two or three years ago "look like mere elementary toys," Twining explained. Bombsights of World War II weighed less than 100 lb., while today's bomb-aiming mechanisms weigh thousands of pounds. He described the elaborate electrical computing systems in bombsights as comparable in some respects to electronic brains.

"Combat airplanes of today are as far advanced over the World War II planes as those planes were advanced over the automobile," the general said. "If World War III is forced upon us, our hope of eventual victory will be just as dependent upon the skill and training of our crews as upon the perfection of our equipment."

Jet Target Test







Picture sequence shows British-designed Jindivik radio-controlled jet target plane taking off (left photos) and landing (right) during tests at the Long Range Weapons Establishment, Woomera, Australia. Craft is 22 ft. long and wings are 19 ft. span. Powerplant is a 1,000-lb.-thrust Armstrong Siddeley Viper. Later Mk. 2, of which more than 50 have been ordered, will be powered by 1,600-lb.-thrust Viper. The craft takes off from a tricycle dolly having a gyro-controlled nosewheel. When craft's airspeed indicator attains a pre-set speed, an electrical circuit closes, applying correct up-elevator and the craft takes off. Brakes are simultaneously applied to the dolly's rear wheels. A small amount of down-flap is achieved automatically on takeoff, which takes approximately one and a half seconds. On landing, retractable skids are lowered by radio.

Latest Allied Jets Vie at Paris Air Show

By Ross Hazeltine
(McGraw-Hill World News)

Paris—France staged her twentieth international air show at Le Bourget Airfield to the accompaniment of a series of sonic "bangs" as jets broke through the sound barrier for the first time before the French public.

The show was a great success. Record crowds thronged the big glass-walled exhibition hall, strolled among the parked aircraft just outside and craned necks skyward to see crack pilots put their planes through their paces during the June 26-July 5 display.

Helicopters shuttled busily back and forth carrying passengers from the edge of Paris to the exhibition grounds. There were aerobatics by French, U. S. and British air force squadrons, a formation flight of 200 NATO planes and a mass drop of French army parachutists.

▶ **Nine-Nation Exhibit**—This year approximately 160 exhibitors from nine nations—France, Britain, the United States, Sweden, Italy, Belgium, The Netherlands, Luxembourg and Spain—displayed equipment and planes ranging from rubber life rafts to a sleek new de Havilland Comet 1A recently bought by the French airline, Union Aeromaritime de Transport.

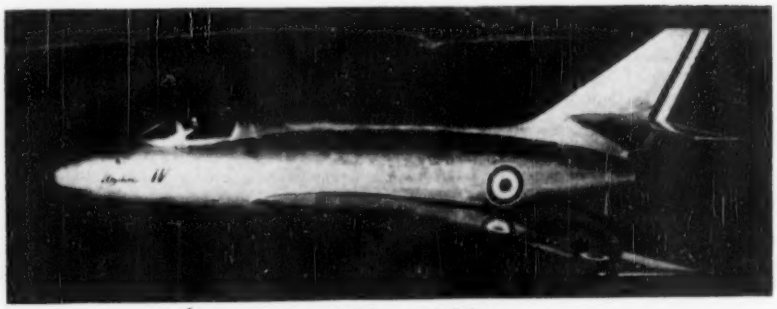
A Royal Canadian Air Force F-86E Sabre was the first plane to crack the sonic barrier. Two French jets—Marcel Dassault's Mystere 4 piloted by Col. Constantine Rozanoff and the S.O.4050 Vautour built by Societe Nationale de Constructions Aeronautiques du Sud Ouest and piloted by Jacques Guinard—and two British planes, the Hawker Hunter with Neville Duke at the controls and the new Vickers Supermarine Swift 4 flown by Michael Lithgow also performed the feat.

The French government has just placed an order for a pre-production batch of the S.O. 4050 sweptwing twin-jet fighter-bomber covering several versions of the plane.

▶ **Sncaso's Trident**—Fastest plane in the show was S.O. 9000 Trident which is expected to reach Mach 1.6. The Trident is powered by two Turbomeca Marbore jets of 880 lb. thrust each and carries tail rockets to push it through the sound wall. It made its first flight Mar. 2 and has not yet been tested with its rocket power. The plane flew at Paris with only the jets operating.

The Trident and the S.E. 5000 Baroudeur built by Societe Nationale de Constructions Aeronautiques du Sud Est illustrate the efforts of French builders to develop lighter, cheaper interceptors capable of operating from

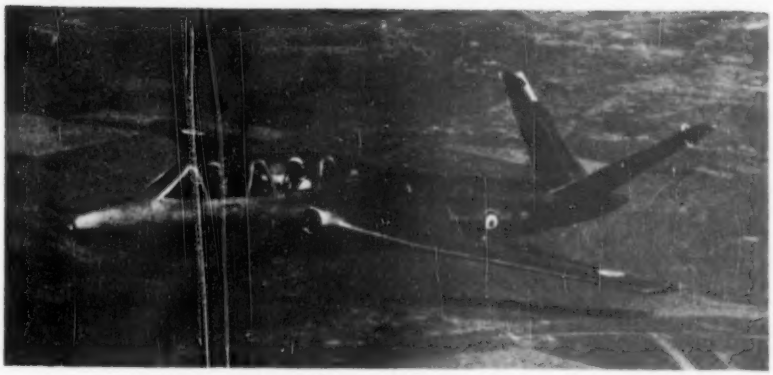
Sncase S.E. 210 Caravelle transport model



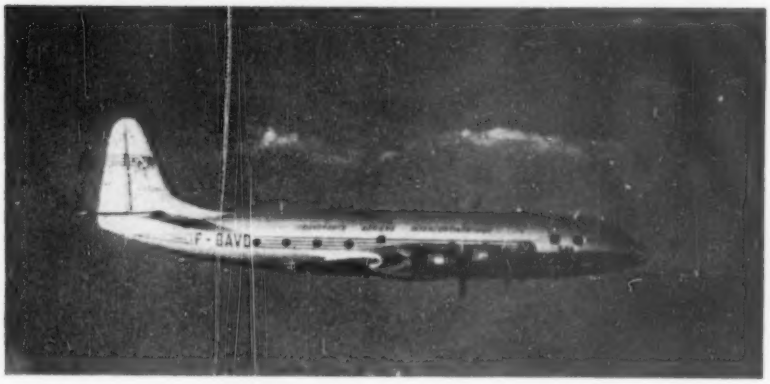
Dassault Mystere 4 fighter

Sncaso S.O. 4050 Vautour fighter-bomber

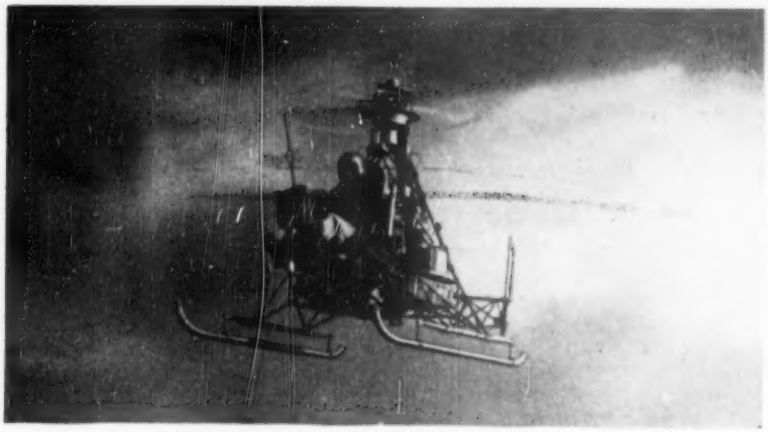
Sncaso S.O. 1120 Ariel jet copter



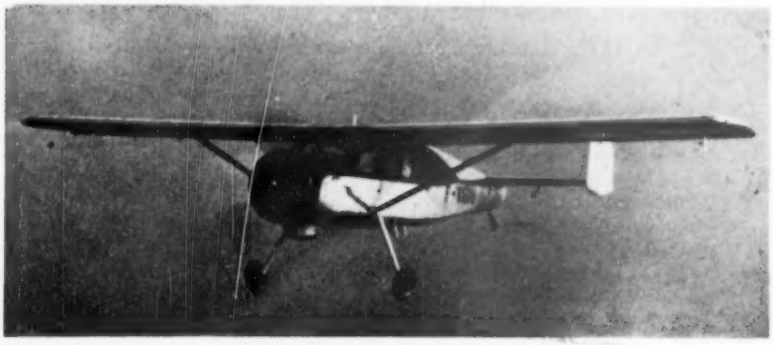
Fouga Magister 170R-01 trainer



Sncase S.E. 2010 Armagnac transport



Sncaso S.O. 1220 Djinn jet copter



Max Holste M.H. 1521 transport

less elaborate strips than those required for today's standard fighters.

Sncaso claims it can build the Trident for between one-third and one-fourth the cost of an F-86 Sabre, a Hawker Hunter or Dassault's Mystere. The Trident is a far lighter plane with much shorter range, but its makers believe it will prove to be well suited to French requirements. They say France is, after all, only 15 minutes jet flying time from the Iron Curtain and would be better served by a larger number of short-range but fast interceptors operating from relatively inexpensive landing strips than by bigger, more expensive fighters.

▶ **Sncase's Baroudeur**—Sncase's answer to this problem is the S.E. 5000 Baroudeur. This plane has not yet flown and was presented at the air show only as a small-scale model. The Baroudeur is capable of taking off from almost any field and it lands on skids in a very short distance.

Takeoff is made from a tubular-steel dolly equipped with six rockets which fire the plane into the air. The plane is pulled onto the carriage by a jeep, its landing skids retracting automatically in the process.

The Baroudeur is powered by a Snecma Atar 101C engine of 6,160 lb. thrust. Span is 32 ft. and the wings are sharply swept. Length is 44 ft. The plane weighs a little less than five metric tons. It is armored and designed principally for ground support. Sncase expects it will be able to operate from fields about 700 yd. long.

Other French combat planes presented were the Sncase Mistral, a slightly modified French version of the British DH Vampire, and the Sea Venom, which Sncase also is building under DH license. The S.E. 2410 Grognard, a big heavy attack plane powered by two Hispano-Suiza Nenes in the fuselage, was displayed in public for the first time. Development of the Grognard has been stopped, but the plane is now used to test special equipment.

In addition to the F-86E, the Hunter and the Swift, the foreign military planes in the show included the U.S. Republic F-84G and Douglas B-26, the British English Electric Canberra jet bomber, Sweden's piston-engine Saab Safir, Holland's Fokker S. 14 jet trainer and Italy's Macchi 323 trainer.

▶ **New Jet Trainers**—Two light French jet trainers, the Fouga 170R Magister and the Morane 755 Fleuret, also attracted attention. Military missions from the U.S., Britain and several continental European nations are studying both these planes. The French Air Ministry is testing them with an eye to ordering one into production.

The Magister is a tandem two-seater powered by two Turbomeca Marbore jet engines of 880 lb. thrust. It is equipped with a pressurized cabin and

retractable landing gear. The plane cruises at 400 mph. Span is 37 ft., length 32 ft. and total weight 5,480 lb.

The Morane Fleuret first flew Jan. 29. It seats two side-by-side, has a pressurized cabin, retractable landing gear and also is powered by two Turbomeca Marbore engines. Cruising speed is 403 mph., span 31 ft., length 32 ft. and total weight 5,491 lb.

In a demonstration before the American military mission in May the Morane 755 landed from a test flight, was partially disassembled, then reassembled and back in the air within three hours. In disassembly, the engines, fuel tanks, canopy, seats, and most special equipment were removed and replaced.

► **Jet Transports**—Star of the transports on exhibition was undoubtedly UAT's new Comet 1A. The French industry has yet to build its first jet transport, but plans for two have been approved and work is underway. Sncase and Sncaso will cooperate to build the twin-jet S.E. 210 Caravelle. Hurel Dubois also is planning a two-jet plane, the H.D. 45 (AVIATION WEEK Jan. 12, p 34).

Feature of the Caravelle's design is the location of the engines in nacelles on either side of the fuselage just forward of the tail. Sncase believes this arrangement will allow the sweptback wings to be built with optimum aerodynamic characteristics and will reduce engine noise within the cabin.

The Caravelle will be powered by two Rolls-Royce Avon R.A. 16 engines of 9,000 lb. thrust each. It is designed to carry 70 passengers over a maximum range of 2,200 mi. Cruising speed will be 450 mph. Wingspread will be about 110 ft., length about 100 ft. and maximum gross weight about 85,000 lb.

The H.D. 45 will be the jet successor of the H.D. 31 which is now proving in tests to be an extremely economical cargo carrier. Like the H.D. 31, the jet H.D. 45 will be a high-wing monoplane with a high-aspect-ratio wing. Ratio will be 18.5. It will also be powered by two Rolls-Royce Avon R.A. 16 engines of 9,000 lb. thrust. Wingspread will be 150 ft., length 100 ft., cruising speed 440 mph., range 1,500 mi. and total weight 90,000 lb.

Other French transports in the show included the two big four-engine planes, the S.E. 2010 Armagnac and the Breguet Deux Ponts, both of which have been flying since 1949 and are in commercial service. Two-engine French transports on display were the Nord 2501 Noratlas, which first flew in 1950 and the S.O. 30 Bretagne experimental version powered by two Snecma Atar 101B engines of about 5,000 lb. thrust. The production version of this plane has two Pratt & Whitney R2800-CA-18 engines.

Foreign transports included the UAT Comet, an Air France Super Constellation, a DC-6B, a Boeing Stratocruiser, a Bristol Britannia and a Fairchild C-119.

► **Small Planes**—The Sipa 200 Minijet, built by Societe Industrielle Pour L'Aeronautique and said to be the smallest jet plane in the world, was the most interesting of the lightplanes.

The Minijet is a two-seater that first flew Jan. 14, 1952. It can be used for training or as a personal plane. It is powered by a Turbomeca Palas engine of 330 lb. thrust. It cruises at 217 mph. and lands at 56 mph. Span is 22 ft., length 16 ft., total weight 1,675 lb. and range 350 mi.

A light transport, the Max Holste 1521 Broussard, was one of the new lightplanes on exhibition. It first flew Nov. 17, 1952. The Broussard is a single-engine plane with a Pratt & Whitney 455-hp. engine. It carries a pilot and five passengers, can take off in 410 ft. and cruise economically at 146 mph. Span is 44 ft., length 27 ft., total weight 5,200 lb., range 750 mi.

► **Many Copters**—There were plenty of helicopters on display. During the show, Sncase's S.E. 3120 Alouette, a light three-seater, set a new world record for helicopters over a closed circuit by flying 751.2 mi. in 11 hr. 37 min. The Alouette is powered by a Salmson 9 NH of 203 hp. Length is 34 ft., blade diameter 38 ft., and total weight 2,778 lb.

Sncaso displayed two jet helicopters: the S.O. 1120 Ariel and the S.O. 1220 Djinn. The Ariel is powered by a Turbomeca Artouste turbine which drives the rotor compressor. Rotor diameter is 36 ft. and total weight is 2,645 lb. The Djinn, a skeleton-like aircraft of tubular steel construction, is powered by a Turbomeca Palouste. The two-seat production version of the Djinn will weigh only 1,100 lb. and will cruise at 60 mph.

Among the foreign helicopters on display were the Sikorsky S-55 which will be built under license by Sncase in cooperation with Fiat, Italy, the Bell 47 and the Hiller 360.

New Aro Pact

Air Research and Development Command is negotiating a new contract with Aro, Inc., a subsidiary of Sverdrup & Parcel, St. Louis construction firm, for the resumption of operating the Arnold Engineering Development Center at Tullahoma, Tenn. The new contract will be a cost-plus-fixed-fee type.

The new contract will permit Aro to take over AEDC operations from the Operating Division of Sverdrup & Parcel which has been handling the work pending outcome of a congressional decision on the role of Aro. Recent congressional action approved by President Eisenhower removed restrictions on payments of further federal funds to Aro. The company is scheduled to renew AEDC operations about Aug. 1 when the USAF contract with the S&P Operating Division expires.

Assistant Secretary Smith

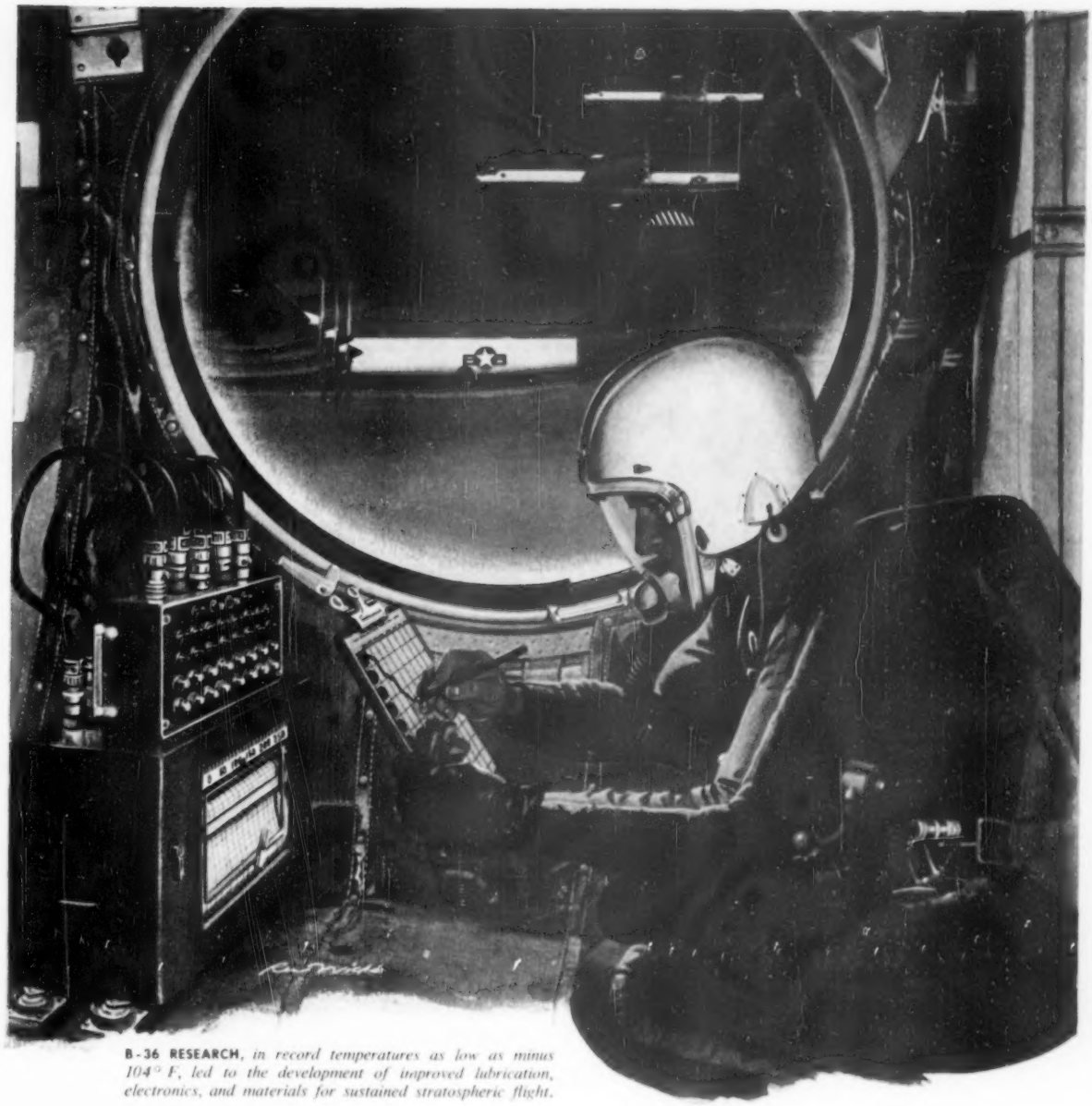
Smith Is New Navy Air Secretary

James Hopkins Smith, Jr., naval aviator and former airline executive, last week was nominated Assistant Secretary of the Navy for Air—an appointment forecast by AVIATION WEEK (July 6, p. 15). He succeeds John F. Floberg.

Promoted this year to captain in the Naval Reserve, Smith enlisted in the Navy as a seaman 2nd class in 1931, later completed flight training and was commissioned a reserve ensign at Pensacola, Fla. During World War II, he served as a torpedo bomber pilot aboard the aircraft carriers Belleau Wood and Yorktown, was on the staff of Adm. Arthur W. Radford, new chairman of the Joint Chiefs of Staff. Smith has been special assistant to the Navy Secretary since 1951.

The new Navy Air Secretary managed Pan American World Airways' African operation before the war, returned as vice president of PAA's Atlantic Div. He recently resigned as a director of Slick Airways.

New Assistant Secretary of the Navy is Raymond H. Fogler president of W. T. Grant & Co., succeeding Herbert R. Askins, resigned Jan. 20



B-36 RESEARCH, *in record temperatures as low as minus 104° F, led to the development of improved lubrication, electronics, and materials for sustained stratospheric flight.*

CONVAIR'S B-36: *stratosphere laboratory*

In the aerial wilderness above 40,000 feet, where temperature and pressure are paralyzing hazards, Convair's B-36's leave reassuring contrails.

The B-36 intercontinental bomber is still the strategic weapon of the Air Force, capable of atomic retaliation anywhere. Equally significant, is the B-36's vital role of "flying laboratory." Seven years' experience in sustained high altitude flying by Convair and its Air Force partners has given both our military and transport designers research needed for the greater efficiency of men and equipment in outer space.

Up there in the stratosphere and beyond lies the key to national defense and the vast new freedom of global air travel. Aircraft for these heights will continue to be built by Convair...through engineering that aims at the *maximum* of air power...

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CONVAIR

"Plug-in, plug-out" simplicity in Avien's "TWO-UNIT" FUEL GAGE

This "repackaging" of Avien's capacitance-type fuel gage is 50% lighter and needs no field adjusting.

Up until now, most fuel gaging systems needed four units: a tank unit, an indicator, a bridge-amplifier and a shockmount.

No field calibration was required for the Avien tank unit or indicator. Avien held them to such close tolerances, the adjustments for individual installations were actually "built-in."

The bridge-amplifier (the "black box") was a different story. This intermediate unit was supplied as a common part, for universal application. And that's where field calibration *had* to be made.

There was only one answer, as far as Avien was concerned. The "black box" had to go.

Now, in the Avien Two-Unit system, the necessary components for the bridge and amplifier functions have been built into the indicator case. The "black box" is eliminated, and so are many parts which were necessary to make the "black box" universally applicable.

The Two-Unit Gage gets installation down to "plug-in, plug-out" simplicity. No more field calibration is necessary – and that means that all units designed for the same aircraft are interchangeable. Avien units are now all "shelf items."

To install the Two-Unit Gage, you *don't* need trained personnel, you *don't* need specialized equipment, and you *don't* need calibration instruction or data.

This new "package" brings savings all along the line. The basic system is reduced in weight by 50%. Installation time is cut. Less wiring and connectors are needed. Less maintenance is required. Trouble-shooting becomes easier. And fewer parts must be stocked for maintenance and repair.

As in the previous system, additional functions for fuel management can be integrated into the basic gage – and with less complexity than ever.

The Avien Two-Unit Gage is now available to meet your manufacturing schedules. The indicator is available in either large or small sizes, with all varieties of dial configurations.

Every month, Avien produces over ten thousand major instrument components for the aviation industry.

We believe that Avien's Two-Unit Gage will contribute to the obsolescence of many earlier systems, including our own. For further information, write or call us.

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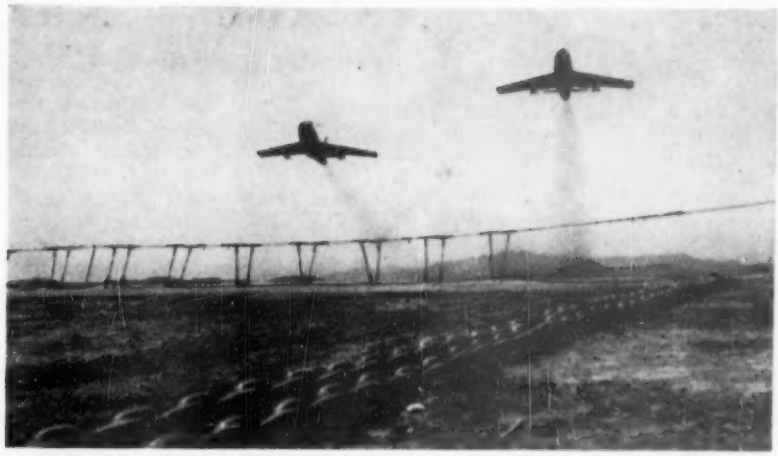


ARRESTING GEAR stretches across runway at Korean air base during F-86 takeoffs.

Crash Barriers Save AF Jets

Nine of 10 fighters that crashed into runway gear suffered little more than damaged wheel fairings.

Seoul, Korea—More than $2-million worth of USAF jet aircraft has been saved from serious damage or destruction by a crude runway arresting gear erected at two fields in Korea for less than $40,000 for four installations (AVIATION WEEK June 15, p. 18).

This barrier someday may be installed at every U. S. jet airbase, eliminating need for over-run stretches to accommodate abortive takeoffs and emergency "long" landings.

Safety officers objected to original designation "crash barrier" because they felt it had an adverse psychological effect on pilots. Official name now is "runway arresting gear."

▶ **Tennis-Net Barrier**—It is a simple contraption. Two four-ft. high stanchions that raise and lower are built into concrete platforms 150-ft. apart on either side of the over-run.

Between them is a nylon rope attached near the top. A steel cable runs between the stanchions at the bottom, attaching to two iron link chains on either side of the over-run.

Chains weigh a total of 39,000 lb. They stretch out approximately 400-ft., parallel to each other and to the over-run.

Snaps connected to the nylon rope hold the cable to over-run surface. When stanchions are raised, the gear resembles a tennis net.

▶ **Little Damage**—An overshooting jet strikes nylon webbing with its nose wheel. The action snaps up the steel cable, which engages the main landing-gear struts.

Force of the aircraft impact on the cable drags iron chains behind the decelerating plane.

Since runway arresting gear was installed in April, 10 jets in Korea have crashed into the barrier—four on abortive takeoffs and six on landings. No pilot has been injured or killed.

Except for an F-86 Sabre that overturned after hitting the barrier, all jets striking the arrestor have been disentangled with little more than damaged wheel fairings.

▶ **Pilot Confidence**—Some pilots at first objected to the chest-high rigging on grounds that it might ensnare a heavily loaded aircraft making low but successful takeoff. It hasn't, and most pilots now have confidence in the arresting gear.

Barriers are set up at K-2 in Taegu and K-14 at Kimpo. They are raised during all major takeoff and landing operations.

Here is how the gear worked in three cases:

• **A Sabre pilot** of the 51st Fighter-Interceptor Wing returning from his mission was very low on fuel and landed "long and fast." He struck the barrier at about 150 mph. His main wheel struts engaged the steel cable 48 ft. from the right stanchion. After moving 32,232 lb. of chain, the plane stopped with only minor damage to gear fairing doors.

• **An F-84 pilot** of the 58th Fighter-Bomber Wing blew a tire and lost control of his plane on takeoff. He was carrying two 1,000 lb. bombs and full tip tanks. He stop-cocked throttle and hit the barrier in the center at about 150 mph. The plane stopped in 471 ft., moving all but three ft. of chain on each side.

Without the barrier, the F-84 probably would have crashed into a drainage ditch 500 ft. away. An official report said in this case the aircraft "undoubtedly" would have been destroyed and the pilot "injured, if not killed." Report listed the case as an "incident" instead of an accident "because damage was so negligible and there were no injuries."

• **Pilot whose Sabre** flipped over after striking the barrier was coming in "long and fast" and was low on fuel after a combat mission. He locked his brakes 500 ft. before hitting the arrestor. This pulled the plane to the left. It crashed into the barrier 45 ft. from the left stanchion in a skid to the right. The main landing gear picked up the cable, but the nose gear collapsed and the right wing tip dug into the ground. Plane flipped onto its back and skidded 240 ft. Impact of the crash moved 27,000 lb. of chain.

The aircraft virtually was destroyed, but an official report said "plane would have been destroyed anyhow." Next day the pilot flew another mission.

▶ **Practical Gear**—Cost of arresting gear is estimated at $9,000 per rig. Each field equipped with it has two barriers, one at each end of the runway.

The 800 ft. of chain for one barrier costs approximately $5,600. Each link is about a foot long, weighs 51 lb. and costs $7.00.

Nylon webbing, replaced after each incident, costs $126.

Stanchions, raised and lowered manually, cost $3,318 per pair.

Runway Arresting Gear is the result of many minds contributing to meet standards set by Maj. Gen. Samuel R. Brentnall, Far Eastern Air Force vice commander who conceived the idea and supervised development at AF's 6400th Maintenance Group in Japan.

Brentnall wanted a practical arresting gear with these attributes:

• **Easy maintenance.**

• **Economical to build.**

• **Air mobility.** (The chain can be dismantled and flown out in case the field is evacuated).

▶ **Rube Goldberg Invention**—In tests and emergency uses, pilots reported only "mild shock" after crashing into the barrier. Peak of deceleration is listed at 1.65G. It takes two to three Gs to produce severe shock).

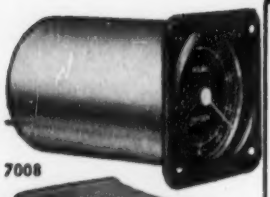
Peak of deceleration is reached when the plane has pushed about 30 ft. through the barrier.

Drag rise is gradual and does not exceed normal stress limits of the aircraft.

To date, arresting gear in Korea has stopped three RF-80s, three F-84s and four F-86s. Together, these aircraft cost about $2,350,000.

One air safety officer said: "That's a lot of money to save with a Rube Goldberg invention. I call it practical engineering."

TIMING DEVICES *for* MILITARY APPLICATIONS



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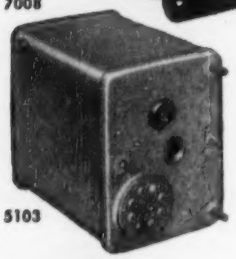

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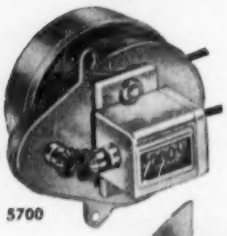

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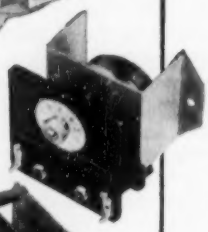

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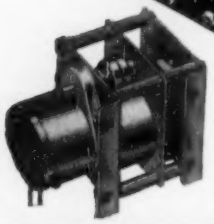

5148

HAYDON*, through research, development and engineering, is able to introduce timing motors and devices that offer major advances over previously available equipment. The 7008 Series Elapsed Time Indicator is an outstanding example. Designed specifically for 400 cycle operation in airborne equipment. Barrel diameter is only 1.525", is 2-45/64" long and it weighs only 6 oz. Power consumption is less than 3 watts and it indicates in units of tens of hours up to 10,000 and repeats. Write for Engineering Bulletin No. 4.

HAYDON 5700 Series Elapsed Time Indicators provide simple, compact and accurate metering of elapsed time for 60 cycle operation.

HAYDON 5103 Time Delay Relay is designed so that the synchronous motor performs its true function as a time standard. Switching work is accomplished by a relay coil, which, when energized, triggers the load switch for release at the end of the delay time. Write for Engineering Bulletin No. 3.

Series 5900 HAYDON Time Delay Relays provide time delay or interval timing in ranges from 0 to 10 minutes.

HAYDON 5148 Series automatic reset, D. C. timers are very versatile and can be used for either time delay or interval timing.

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Solar Delivers Small Generator for C-124

Solar Aircraft Co. will deliver this month the first of a large order for "the world's smallest" gas-turbine electric generator for the Douglas C-124 Globemaster.

Weight of the 50-hp. turbine, without generator, is estimated at 115 lb.—half that of a conventional independent power source of the same output, the company says. Complete with generator, the unit weighs about 215 lb. and delivers approximately 25 kw. for operating C-124 accessories while on the ground.

The new unit also is turned on during landing and taxi operations as a standby boost for regular powerplant-generator-battery system.

Solar demonstrated the generator unit and a portable Navy shipboard firefighter version of the same turbine in Washington recently to promote Pentagon thinking on these and other potential applications.

Uses cited by Solar officials:

- **Cargo plane accessory power.** Solar says its turbine generator is under consideration for other cargo aircraft than the C-124.
- **Ground engine starting carts.**
- **Aircraft pressurization tests.**
- **Mobile fire-fighting equipment.**
- **General-purpose power unit.** The generator may be used at some Alaskan bases to warm diesel engines in cold weather and to start them.

The turbine's only major disadvantage appears to be thirst for fuel. However, light weight, simplicity and high power output may suit it for many jobs where continuous operation is not required and fuel consumption is not an important consideration. The engine is designed for extreme strength, reliability and to provide simplicity of operation.

Unit going into the C-124 passed its specification tests up to the required 20,000 ft. altitude and −65F temperature.

C-124 Crash Cause: Part Failure, Pilot

The crash of a C-124 near Tokyo that killed 129 Army and AF personnel was caused by mechanical failure and pilot error, Far East Air Forces reported last week.

"Complete investigation showed that the June 18 crash was caused by a sheared generator shaft followed by application of full flaps too early in the approach for a three-engine letdown while returning to the field," the report said.

Pittsburgh Superfine insulation is made in a wide range of densities and thicknesses, with various binders and facings, to meet specific aircraft insulation needs. Both the special aircraft grade—"AA"—and the "B" fiber are available.

Special facilities have been arranged for serving the requirements of the aircraft industry. Our technical staff will welcome the opportunity of providing complete information and assistance with insulation problems. Pittsburgh Plate Glass Company, Fiber Glass Division, 420 Fort Duquesne Boulevard, Pittsburgh 22, Pa. District Sales Offices: Chicago, Cincinnati, Cleveland, Detroit, New York, Washington.

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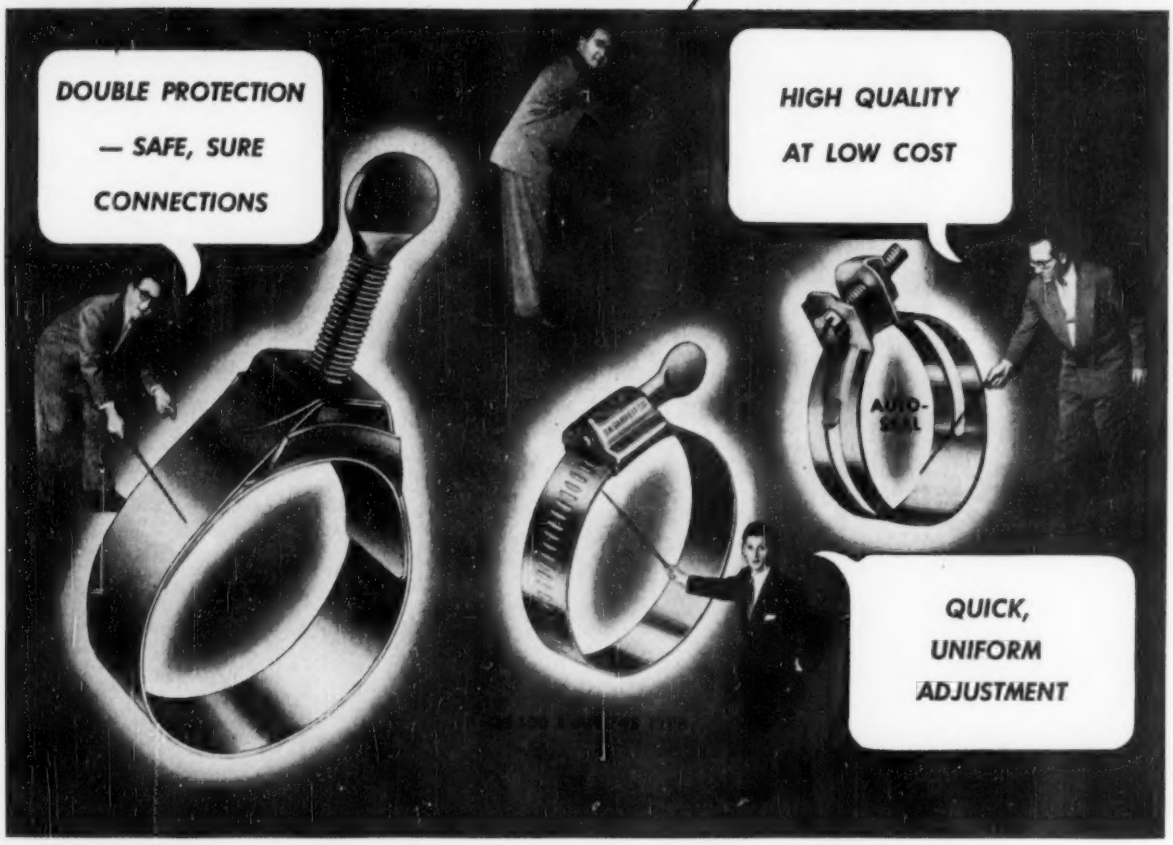

HOSE CLAMPS

AN 737 CLAMP—Approved for aircraft use by the Armed Forces. Stainless steel, radial type, with floating bridge and thumb screw adjustment. Mechanically fastened and spot-welded for double protection.

QS 100 & AN 748 TYPE—Worm type, self-locking screw assures uniform, instant adjustment. Plated to prevent corrosion. Used and approved by the Armed Forces.

AUTO-SEAL CLAMP — Screw-type adjustment, scarfed tongue prevents pinching. Staked bolt and captive nut prevents loss of parts. Rustproofed for long service.

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Army Orders New S-58 Copters

Fiscal '54 program includes purchase of three other helicopters, tests of convertiplanes and fuselages.

First details of the Sikorsky 20-place S-58 helicopter, scheduled to become Army's new standard one-and-a-half-ton cargo copter, military testimony to Congress reveals.

The new rotor aircraft was developed by Navy with Army participation and has been ordered by both services out of fiscal 1953 funds and programmed out of 1954 funds.

In its three military versions, it is designated as Army H-34, Navy HSS-1 and HUS-1.

▶ **Lead Time Edge**—Col. W. B. Bunker, Army Transportation Corps Chief of Air Transport and Service, outlined to the House Army Appropriations Subcommittee the plan under which major 1954 procurement emphasis would be placed on the new Sikorsky helicopter rather than larger three-ton-class copters such as the Sikorsky S-56 and Piasecki H-16. It is expected that because of long lead time, the smaller transport helicopters will be in operation before the larger types are produced, he said.

Col. Bunker said the present Army one-and-a-half-ton helicopter, the Piasecki H-21, "on which we are just starting to receive deliveries," costs practically the same as the proposed S-58.

"The reason for changing models was because we could not get the H-21. Its production was entirely used up by Air Force requirements," he told the subcommittee.

▶ **Four-Blade Rotor**—The new single-rotor helicopter will be larger than the 10-place S-55, now the standard Sikorsky military transport machine. It will be powered by a Wright R1820-82 engine, rated at 1,640 hp. for takeoff and 1,250 hp. for normal operation. The engine is similar to the Piasecki H-21's powerplant.

Although following the same configuration as the S-55, the S-58 utilizes a new four-blade rotor and transmission system and a considerably larger fuselage, representing about as much of a scaleup from the S-55 as that machine did from the older S-51.

▶ **1955 Delivery**—On a basis of lead time estimates made by Bunker, the first S-58s should be delivered to both Army and Navy by January 1955. It is expected S-58s will be phased into the same production lines now making the S-55, which will be phased out as production on the new copter increases.

Plans call for manufacture of the larger S-56, with two five-blade rotors turned by two Pratt & Whitney R2800 engines, and the competitive Piasecki H-16 in a new Sikorsky facility now under construction, Bunker said.

He estimated Sikorsky's S-56 and the Piasecki H-16 each would carry approximately 34 passengers. Bunker qualified the capacity description with this significant addition: "With a helicopter you cannot say exactly, because they are very susceptible to weight; on a 'sunshiny' day they do not carry near what they do on a cloudy day because of atmospheric conditions."

The colonel said lead time on the H-16 and S-56 was approximately the same, about 3 years, but he expects both prototypes to fly this fall. The H-16, he said, was designed for a rescue range of 700 mi., but Army contemplates average missions of only 150 to 200 mi. roundtrip.

▶ **Fiscal '54 Procurement**—Other highlights of Army's aviation procurement for fiscal 1954, as outlined by Army spokesmen to the House subcommittee:

• **Hiller's H-23** utility helicopter is in the program as an interim standard reconnaissance and training craft and to replace attrition losses.

• **Service testing** is scheduled for the Doman YH-31 evacuation ambulance helicopter, powered by a 400-hp. Lycoming engine and designed to carry two litters inside the cabin instead of in external capsules. (A later version of this four-blade hingeless rotor machine, to be powered by two Boeing 502 gas turbines, also is under development.)

• **Piasecki H-21** is under a design study project started last year—testing the competitive advantages of plastic, steel and standard fuselage construction. Army has been disappointed that conventional fuselage configuration appears most economical. Actual evaluation of

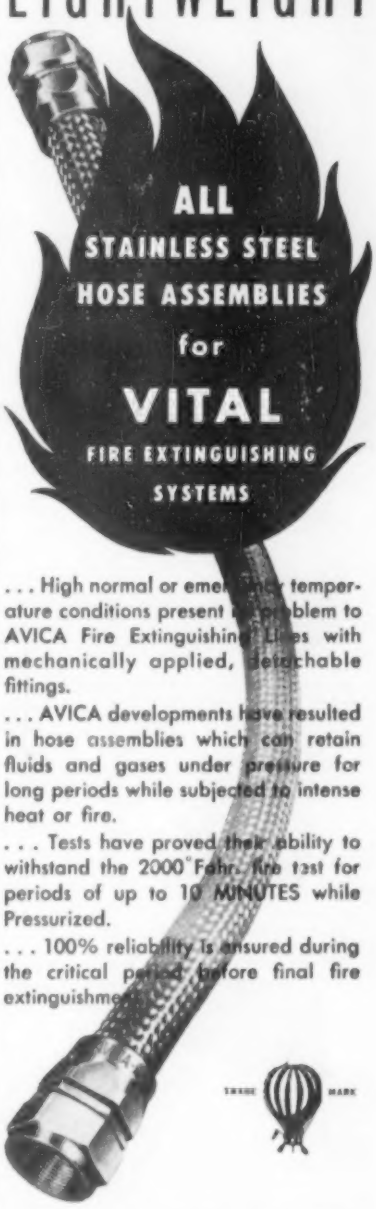
Army Air Spending

Department of the Army will spend more for aviation in fiscal 1954 than in any year since Air Force was separated from Army. Most of it goes for helicopters, the rest for light fixed-wing planes.

Expenditures of $146.7 million are programmed for fiscal 1954, compared with $81.4 million (revised estimate) for fiscal 1953. Army officials told the Army Subcommittee of the House Appropriations Committee that the $146.7-million figure was cut back from the original 1954 budget request of $150.9 million.

AVICA

LIGHTWEIGHT



. . . High normal or emergency temperature conditions present no problem to AVICA Fire Extinguishing Lines with mechanically applied, detachable fittings.

. . . AVICA developments have resulted in hose assemblies which can retain fluids and gases under pressure for long periods while subjected to intense heat or fire.

. . . Tests have proved their ability to withstand the 2000°Fahr. fire test for periods of up to 10 MINUTES while Pressurized.

. . . 100% reliability is ensured during the critical period before final fire extinguishment.

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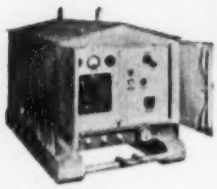
supplies
for ground
installations

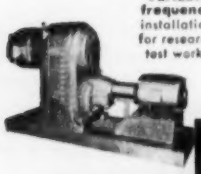
American Electric supplies these complete, *"packaged unit"* power supplies for *all* high frequency requirements. Noted for their rugged, reliable performance, the amazingly low maintenance factor of American Electric alternators results from a unique and exclusive design principle: *a rotating inductor without coils; without springs, slip rings or brushes!* Nothing to wear out, nothing to service . . . *as maintenance-free as its two sealed ball bearings!*



Semi-portable, skid-mounted missile launching power supply completely weather protected.

Portable, caster-mounted 400 cycle installation for production test equipment.

Stationary installation, vee belt drive, resilient mounted for laboratory h.f. test equipment.



Variable frequency installation for research test work.

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Portable, semi-portable or stationary types, open models or completely enclosed for weather protection. Caster or pneumatic tire mounts, skid mounts and resilient rubber mounts on stationary types.

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Fixed Frequencies from 250 cycles to 2400 cycles (up to 4000 cycles in the lower ratings).

Variable Frequencies from 380 cycles to 1200 cycles and 1200 cycles to 2400 cycles.

Excellent Voltage Regulation: Standard ± 1% to as low as ± .5% depending upon choice of drive. Electronic regulators or magnetic amplifier regulators supplied.

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Exceedingly low harmonic content results directly from alternator design without use of filters.

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(outputs up to 75 KVA available in other alternator designs.)

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the project is to be financed in 1954.

• **Cessna L-19 Bird Dog** two-place liaison plane, continues in the program for 1954 to replace attrition losses and to provide 119 planes for the Republic of Korea army.

• **De Havilland (Canada) L-20 Beaver** five-place staff transport plane, continues as initial equipment for authorized units, to replace attrition, and to provide 25 planes for the Republic of Korea army. (Omission of the Beech L-23 Twin Bonanza from Army's 1954 program indicates the Beaver is preferred in the staff transport category.)

• **De Havilland (Canada) Otter,** a larger version of the L-20 Beaver, is scheduled for a service test.

• **Jet rotor helicopter.** Not specified but presumably the Hiller Hornet H-32 ramjet or the American Helicopter H-26 pulsejet, or both, is on Army schedule for further service test.

• **McDonnell L-25 convertiplane,** combining rotor and fixed-wing principles, that seeks higher speeds than the copter offers and less landing area than the airplane requires, is scheduled for service evaluation. (Omission of two other convertiplane designs competing with the L-25-Bell Model 200 and Sikorsky S-57—may suggest these two craft are not supported in the Army 1954 program).

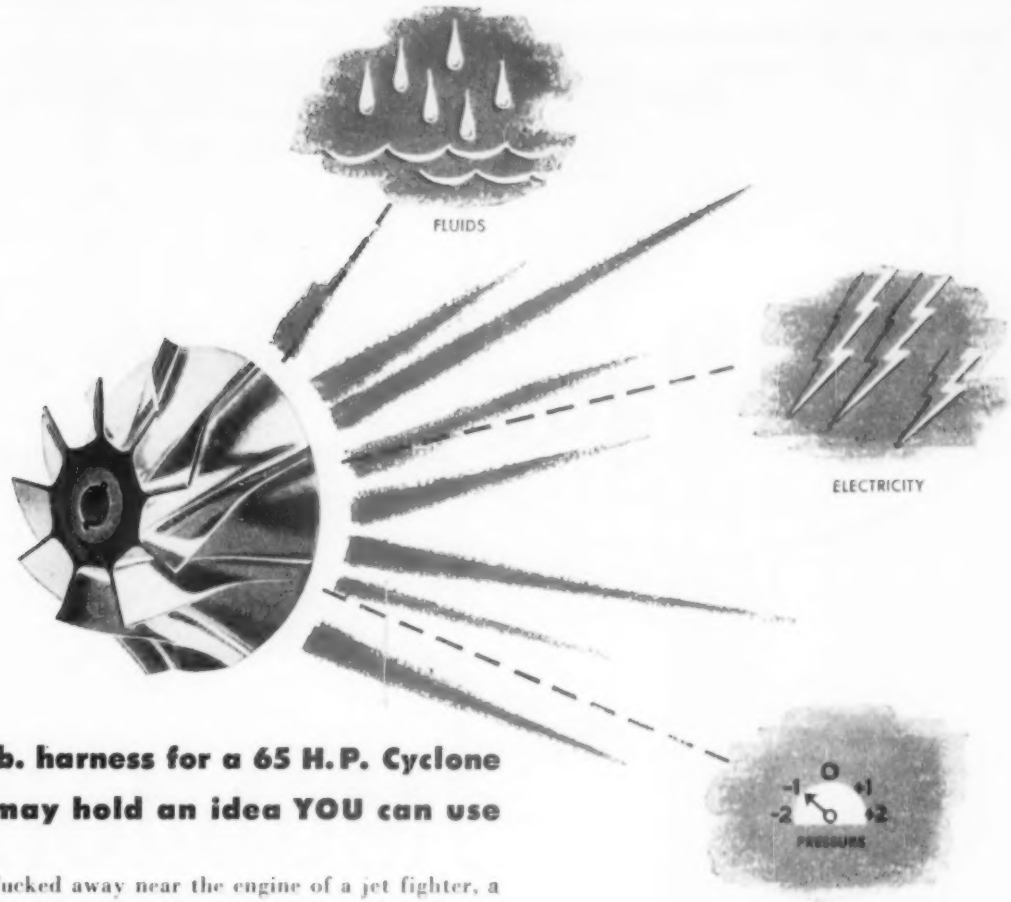
▶ **Nets Not Pods**—Discussing a sketch of the Piasecki H-16 with the Congressional Committee, Colonel Bunker pointed out that, although the artist had shown the craft supporting a cargo pod, the Army expected to use cargo nets slung under the fuselage. Army considers pods impractical for relatively slow craft like helicopters, he said.

Army sees the helicopter as a flying truck to haul cargo or to bring troops into an area difficult for surface transportation, he explained.

Use of helicopters will make possible a 14% reduction in the number of surface trucks needed. A helicopter is not more vulnerable than a truck, Army believes. However, Army does not feel that the copter, because of its slow speed, has a good chance of survival as a troop carrier transport flying over enemy forces.

How to Plan Air Terminals

A method of planning airport building areas to take care of anticipated growth is detailed in a new booklet costing 25 cents. Centralized, consolidated, one-and-two-level methods for handling passengers, baggage, mail express and cargo are also covered. Schematic drawings illustrate terminal requirements. The booklet, Airport Terminal Buildings, published by the Office of Airports, Civil Aeronautics Administration, is issued by Superintendent of Documents, Washington, D. C.



This 12 lb. harness for a 65 H.P. Cyclone ...may hold an idea YOU can use

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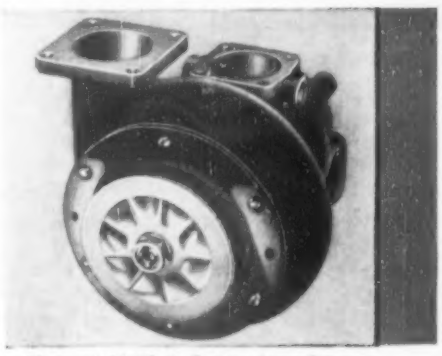

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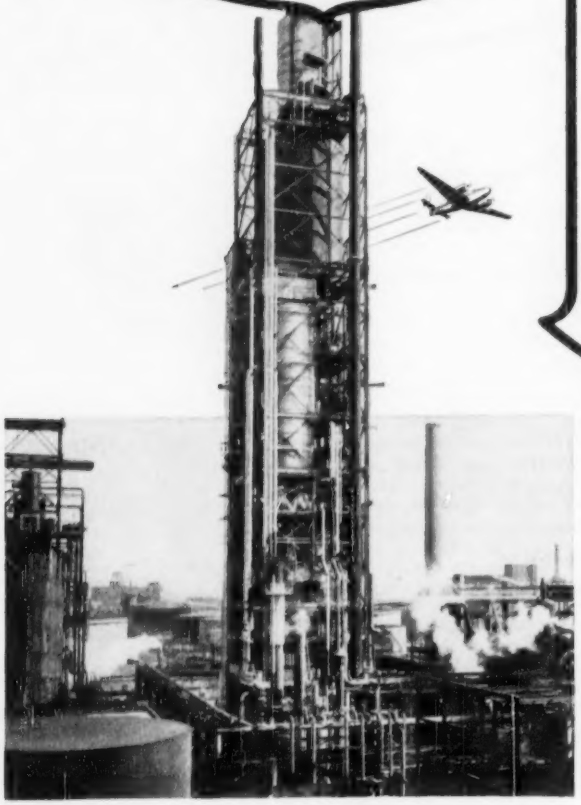

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SAE Forum Exchanges Information on:

Making Jet Buckets and Blades Better

Panel discussion of manufacturing methods, materials shows usage depends on equipment, experience.

The what, how and why of jet engine bucket and blade manufacture were closely examined at the recent production forum of the Society of Automotive Engineers' National Aeronautic Meeting in New York.

The examination—in the form of a panel* discussion with audience participation—looked into most current manufacturing methods and materials, as well as many still in the experimental and development stage.

The discussions were slanted toward the practical shop level. A major conclusion one could draw from them was that usage varies widely, depending on a particular company's equipment and experience. What is suitable for one organization may not be good for another.

The questions and answers that follow represent the major points studied at the blades and buckets meeting.

Forgings

• WHAT factors should be considered when choosing between rough or precision forgings for processing?

Type of material, quantities involved, surface finish required, tolerances and price should be considered. In general, parts machined from rough forgings will meet closer tolerances than precision forgings, but it is felt the latter can be held to tolerances of .007 in. on contour and ± .0075 in. on thickness in production. Closer tolerances can be held but only at the expense of higher tool and die costs.

Tool, die and lubricant cleanliness must be maintained to insure good surface finish on precision forgings. This is not critical on rough forgings, since stock is removed in finishing. In cases where companies were using both precision forgings and machined rough forgings, the preference seemed about equal.

• DOES forging to size cause excessive grain germination in Nimonic 80 alloy?

Control of grain germination requires a careful control of the percentage of deformation, temperature, and time at temperature. Under 5% deformation per blow increases the tendency to form large grains. It has been found useful to leave the final forging slightly oversize (.010 in. envelope) to permit etch-testing for grain size. One forging vendor reports he has noticed definite evidence of heat variations in grain size. His tests were incomplete, and further work along this line might be beneficial.

• WHAT is the minimum trailing edge thickness obtainable by forging blades from Nimonic 80?

A thickness of .015 in. can be met, but for large production runs .030 in. is more practical because of tooling-life considerations.

• HOW does surface condition of Waspalloy compare with that of S-816?

Surfaces are fairly comparable. Some difference in forging techniques is required, with S-816 somewhat easier to forge. This is probably because of the longer experience with that alloy. As background with Waspalloy is established, it will be quite comparable.

• HOW do Waspalloy and S-816 compare on grain size consistency?

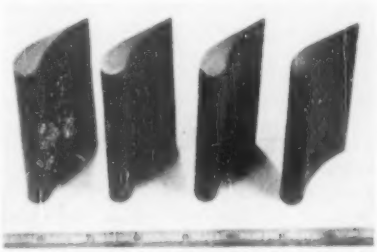
In general, S-816 has been found to be more consistent.

• WHAT is the future of impact forging?

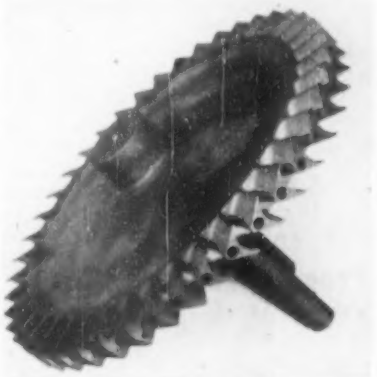
Considerable work has been done recently on this type of forging. Some of the early commercial machines had drawbacks, such as poor feed and positioning mechanisms, and no provision for heating of dies. In some of the newer installations, these have been corrected and a more satisfactory unit produced. There is some doubt as to the possibility of precision-forging by the impactor method.

• HAS any work been done on the nitriding of dies?

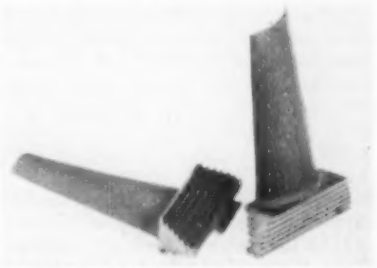
A limited amount of work has been done, but not enough to evaluate the process.



KENTANIUM is being tested in nozzle vanes for turbojet engines . . .



INTEGRALLY bladed turbine wheels, and . . .



TURBINE BUCKETS. Fir-tree fastening (shown) proved unsatisfactory.

• WHAT are the common forging lubricants?

The lubricant used in high-temperature forging is usually colloidal graphite in water. In the case of aluminum, lard is generally used.

Casting

• HOW do you determine whether to cast or forge?

In many cases, the answer is simple because some of the high-temperature alloys cannot be forged. In other cases,

*Panel members: W. M. Williams, factory manager, Thompson Products, Inc.'s Jet Engine Div.; C. C. Clark (panel secretary), assistant factory manager, Thompson's Metallurgical Products Div.; C. P. Brooks, factory manager, Austenal Laboratories, Inc.'s Microcast Div.; L. M. Raring, chief metallurgist, Utica Drop Forge & Tool Corp.; J. V. Rickard, manufacturing engineering manager, Curtiss-Wright Corp.'s Metals Processing Div.; E. H. Jones, executive engineer, Ex-Cell-O Corp.; R. L. Grunewald, components manufacturing section manager, General Electric Co.'s Evendale engine operation; P. C. Ambrose, blades and buckets group leader, Pratt & Whitney Aircraft Div.

such as with the 410-type alloys, the casting difficulties are such that it is more economical to forge.

Another consideration is the physical properties required. Forgings generally have better mechanical properties than castings.

In the choice between sand and precision castings, the cost of finishing must be considered. In some cases, very intricate shapes can be produced by precision castings, with very little finishing required.

• WHAT are normal precision-investment casting tolerances?

A tolerance of ±.006 in./in. is usually held. This will vary somewhat with the size and configuration of the part.

• IS it feasible to cast a disk with integral buckets or blades?

This depends on the tolerances required and repair work permissible. If it becomes necessary to scrap an entire assembly because of a small defect in one blade or bucket, the cost usually becomes prohibitive.

• CAN titanium be cast?

Very little commercial work has been done in the casting of titanium because of its high melting point and extreme affinity for oxygen and nitrogen. All casting would probably have to be done in a vacuum under carefully controlled conditions.

Process Factors

• HOW can twist and bow in blades be controlled?

In blades under 5 in. in length and 1 in. in chord width, twist and bow are usually no problem. Most of the trouble can be eliminated by careful removal of the part from the forging dies and by close attention to the straightness of heat-treat fixtures. Some success has been realized by die or fixture quenching.

In general, it is very hard to suggest corrective measures for this problem because of erratic occurences. It is necessary to solve the problem on each part on the basis of individual behavior.

• HAS the practice of cold-straightening Type 403 or 410 blades been successful?

It is a fairly common and successful practice to cold-straighten these types of blades.

• HAS any work been done on extruding hollow-nozzle vanes?

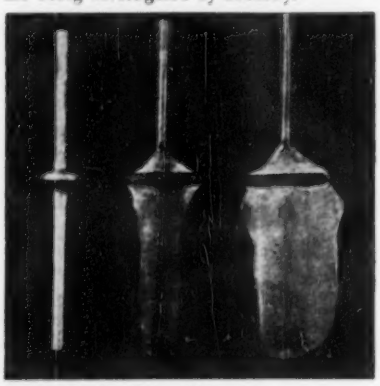
This practice is not widespread. Some use has been made of a process consisting of a deep-drawing operation to form a hollow cylinder, with subsequent pressing operations to form a hollow nozzle vane.

• HAS there been any application of the Electroforming process to the production of hollow blades?

There is no extensive application of this method known to the panel. It is felt the cost and the difficulty of alloy deposition might limit the use of the method.

CERMETS and powdered metals are among newer materials for buckets, blades.

COMPRESSOR blades of titanium alloy are being investigated by industry.



IMPACT forging produces blades.

• WHAT has been the experience with resistance upsetting?

Anvil life is usually very poor because of the localized high pressure. Use of carbide inserts in the anvil face has not helped appreciably because the inserts crack readily. It is not felt that this method presents any advantages over other forging techniques.

• WHERE is the powder-metal blade used and what are its relative properties?

This type of blade has been used in compressor rotor and stator applications. It has an average tensile strength of over 100,000 psi.–somewhat lower than the stainless steel blade, but considerably higher than bronze or aluminum blades. The damping capacity characteristics of the blade are quite good and permit it to withstand extreme vibrational stress.

• WILL there be any application for powdered carbides or cermets as blades or buckets?

Considerable experimental work has been done on these materials, particularly for bucket and nozzle vane materials. The cermets have excellent strength-to-weight ratio, heat resistance, and are somewhat lighter in weight than the usual high-temperature alloys. Their impact resistance is somewhat low because of the low ductility. It is very possible future applications will be found for these materials.

• HAS any use been made of ceramic coatings over low-alloy blade and bucket materials?

This is a fairly new field where considerable experimental work is being done. Ceramic coatings are being tried not only on buckets and blades, but also in combustion chambers and cones. This application presents the possibility of reducing the alloy content on many parts, and research will undoubtedly be continued.

• WHAT methods are used to obtain the fir-tree configuration on the roots of buckets?

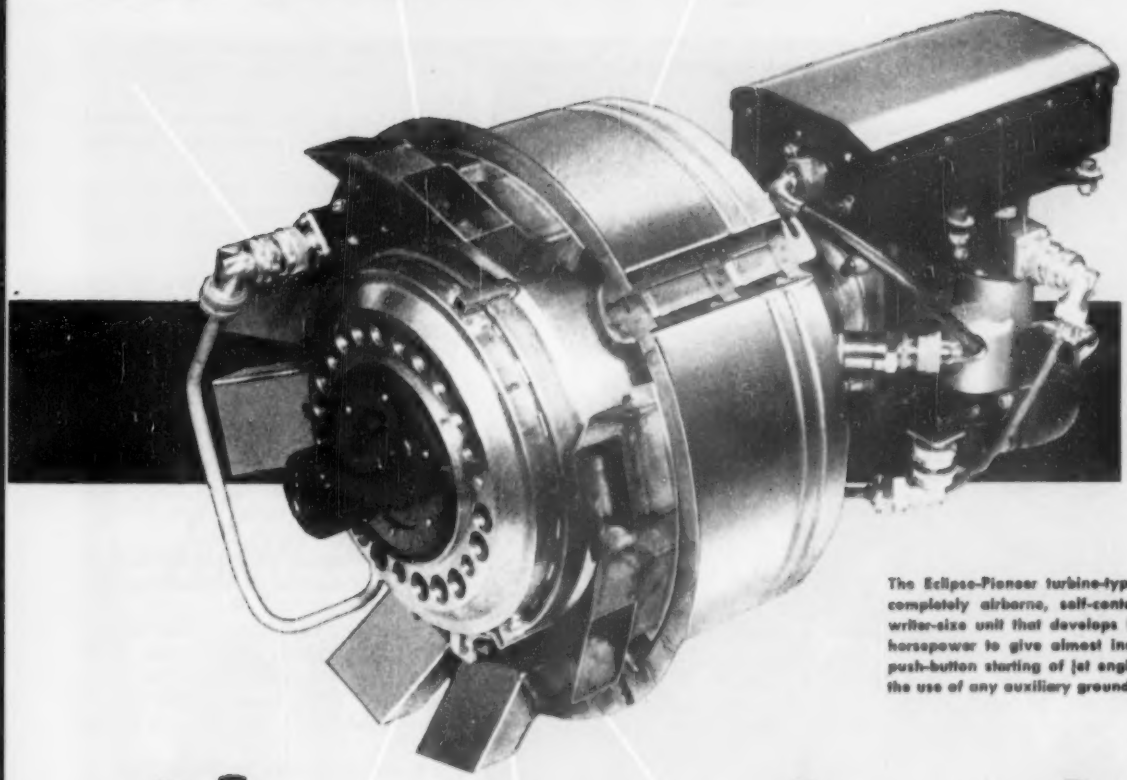
Broaching and grinding are used almost universally to obtain the fir tree. S-816, Nimonic 80, Inconel X, titanium, and 403 are examples of materials that are being broached successfully. Certain of the high-temperature cast alloys give difficulty in broaching and are usually ground. The accuracy by grinding is usually greater, but the cost is also higher.

• HAS increased life been obtained by surface-treating broaching tools?

A number of surface treatments, such as nitriding, electrolyzing, and chromium plating have been tried, but no appreciable benefit has been derived.

Much more important is the broaching speed, feed, and tool material and finish. Correct and adequate fixturing is also very important.

In general, as the alloy content of the material being broached increases, the broaching speed should increase. It is felt that with new broaches soon to



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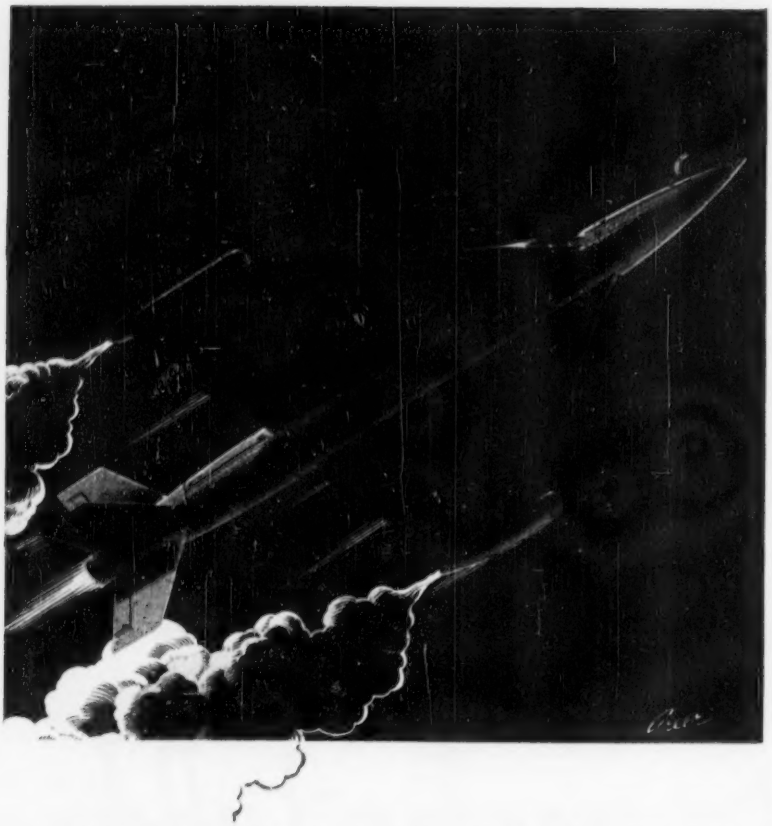

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be available, cuts as low as .0003-.0004 in., and feeds as high as 60 fpm. could be obtained.

• WHAT is the optimum grinding speed for stock removal on Nimonic 80?

It has been found the greatest stock removal with belt grinding takes place at a reduced speed of about 3,600 sfm.

• WHAT is the best method for producing the root radius on compressor blades?

Except where the draw is too deep, the radius can be forged to specifications. In extreme cases, it has been possible to grip the blade airfoil in split precision dies and perform a heading operation on the root. Other methods considered were the use of belt polishers or grinding with a cam follower arrangement.

• WHAT success has been obtained by the use of shuttles or low-melting alloy shuttle forms?

Some companies have obtained good results, others bad. Maintenance of the shuttles is a major factor. The costly inventory for quantity production is also considered to be a drawback in their use.

Some companies prefer a close coordination between the forging and machining vendors so that suitable locating points could be forged onto the parts permitting the use of relatively simple fixtures.

Finishing

• WHAT are the most satisfactory methods of removing scale?

Scale removal is a very important consideration, particularly in forging operations. A number of companies have found sand and grit blasting quite adequate. Others prefer continuous tumbling with an acid-type compound. A few organizations have obtained satisfactory results with the hydride descaling process.

• HOW can the scale on titanium be removed?

Surface forging scale can be removed by blasting. The oxide surface is a very tenacious scale and is very difficult to remove. All heating should be done in an inert atmosphere to reduce oxide formation as much as possible.

Most forging manufacturers remove only the surface scale and permit the oxide to remain on the surface until all forging is complete, removing this surface in the finishing operations.

• WHAT are the usual methods of obtaining adequate surface finish on the airfoil?

The two most common methods are continuous tumbling and longitudinal micro-polish, using one of the commercially available machines. In the case of machined blades, the machined sur-

It takes a tough, heat-resistant bolt to withstand the temperatures of modern jet engines. Today, The H. M. Harper Company is manufacturing bolts, nuts, and other fastenings of the modern high temperature alloys such as Discaloy, Refractaloy, A-286, and special grades of stainless steel. If you require fastenings designed to withstand high temperatures, corrosion, excessive wear, or other extreme conditions, Harper engineers and metallurgists will gladly assist you.

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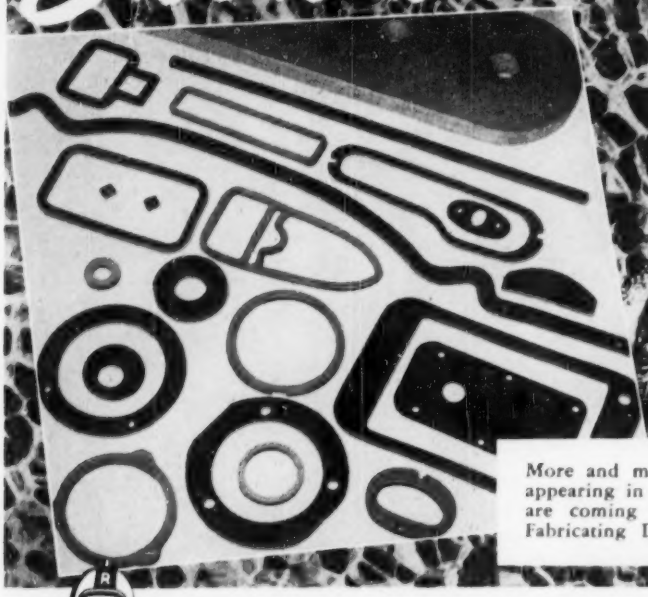

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face is usually a satisfactory method.

• WHAT is a preferred tumbling method?

Continuous wet tumbling has given very good results. Consideration of proper ratio of load to stones and compounds has reduced the nicking problem to a minimum and produced very satisfactory surfaces.

• ARE there any methods for preventing black surface indications from appearing on anodized aluminum parts?

These indications do not react to Zyglo penetrant inspection and are apparently a very superficial surface condition. It has been observed almost universally, but no one has solved the problem completely. The only solution offered is to use a light polish to remove the indication, and then reanodize.

Inspection

• ARE standard specifications covering inspection available?

Inspection standards are usually drawn up by the individual company to fit its own requirements. The SAE is currently working on specifications covering the dimensioning of airfoils. These should be of great value.

• WHAT are the advantages of mechanical, optical and air gages?

The majority of companies use the mechanical guillotine gage for production airfoil inspection. The optical and air gages are used for prototype checking, percentage checking, and receiving inspection.

It is felt the guillotine gage gives the only complete picture of the airfoil because it provides a complete envelope. Wide, flat blades cause considerable difficulty in checking with air or optical gages.

It is generally felt air and optical gages are a relatively new development in the inspection field and more development and familiarity with their potential would increase their use.

• IS the tracing method for checking airfoils in production use?

The stylus and standard templates have been used to check nozzle vanes in production with good results. The method is economical to operate and maintain.

• HAS hard surfacing of guillotine gage templates been tried?

Some work has been done along this line with moderate success. Chromium plate has been tried on the contours and ways. In most cases, it has been found the gages go out of standardization for reasons other than wear and have to be checked and reworked at very frequent intervals.—**Irving Stone**

ASME Meeting Hears . . .

Self-Built Bottlenecks Endanger Production

Los Angeles—George H. Prudden, Lockheed director of quality control, told aircraft engineers gathered here last week for the national convention of the American Society of Mechanical Engineers that they may be engineering themselves into a bottleneck of complexity.

Striking at the complexity problem from a new angle, Prudden warned that machines used in building aircraft are becoming so complicated it is becoming difficult to build them fast enough.

"More and more, airplane builders are dependent on machines—and I mean machines that are becoming terrifically complicated and hard to build in themselves," he said. "The slant of our design is getting too much into dependence on machines. Needing large and intricate machines, loaded with electronic devices, we may be in danger of not meeting our requirements on time for the simple reason that we can't build machines fast enough to build airplanes in the desired quantities."

▶ **Urges Shop Experience**—He also urged young engineers to obtain more

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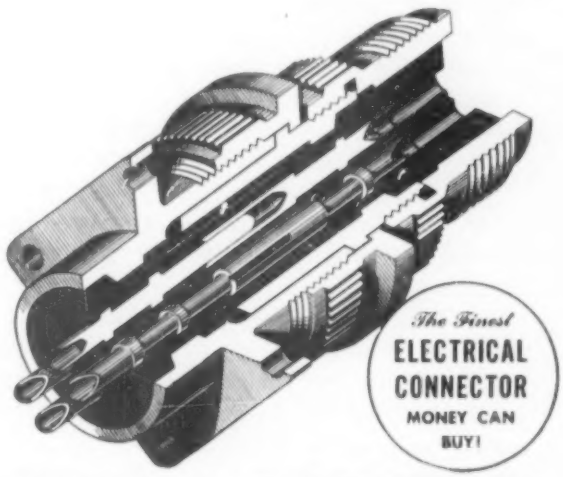

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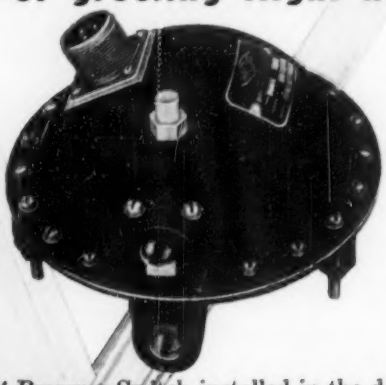
stands up under

thousands of grueling flight hours!



An Aerotec P-904 Pressure Switch installed in the de-icing system of a Boeing Stratocruiser performed without any functional failure during thousands of flight hours. Upon removal, no drift in the pressure setting had occurred, and the unit was still in excellent condition.

Frequently used in the de-icing or cabin-heater systems of larger aircraft, the Aerotec P-904 Type Pressure Switches are also utilized to control ground heating blowers as well as flap, landing-gear and stall-warning devices.

Among the aircraft using Aerotec P-904 Type Pressure Switches are: Boeing B47 Stratojet and B50D Superfortress, Grumman XS2F, Douglas C124C, North American AJ-1 and Chase C123B. More than 15,000 units are in service today.

The exhaustive and conclusive tests of Spec MIL-E-5272 which the P-904 has successfully passed guarantee that Aerotec Automatic Controls will satisfy even the most rigorous specifications.

Aerotec Pressure Switches of various types are available for pressures ranging from 1.5" H_2O to 3,000 psi.

Let our qualified engineering help solve your automatic control problems in the aircraft field. Why not contact us on your pressure switch problems?

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Designers and Manufacturers of Automatic Controls—*Valves*: Regulating, Relief and Check types—*Pressure Switches*: Gage, Altitude, Differential and Absolute Types—*Float Switches*: Top, bottom or side mounted—Single, Dual or Tandem.

shop problems and shop equipment may well spell the difference between a man's being a first-rate or a second-rate engineer 10 years from now."

More than 2,000 engineers gathered at the Statler Hotel for the four-day ASME session, with many of the 50 technical sessions devoted to aviation. At one session, Air Force technical experts described the Air Research and Development Command's propulsion windtunnel at the Arnold Engineering Development Center, Tullahoma, Tenn.

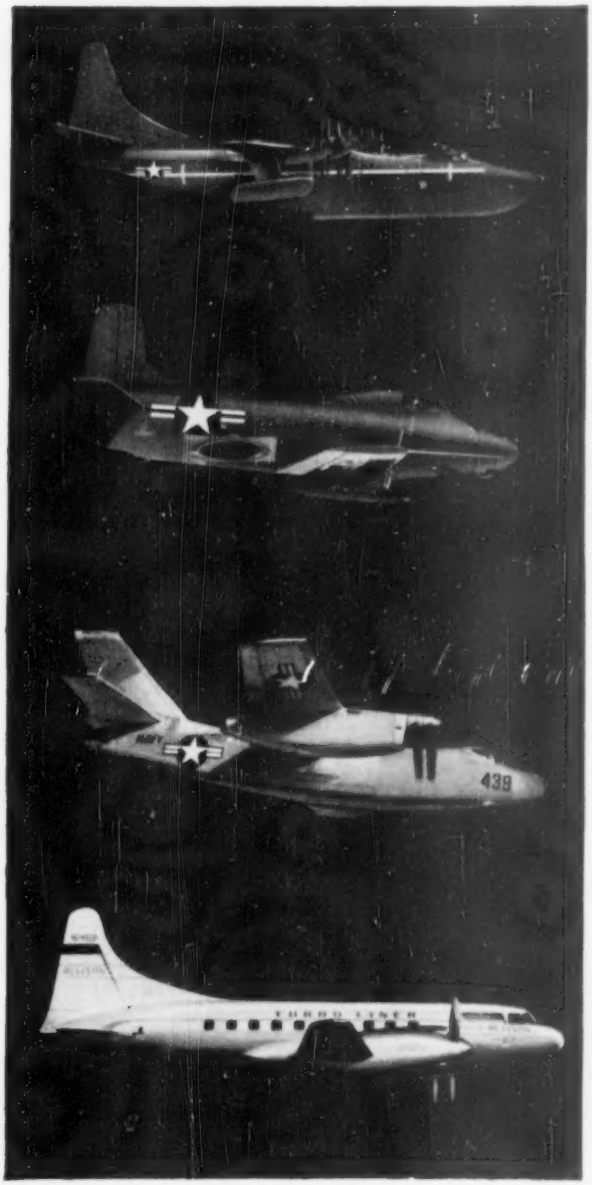
They asserted the Korean war has proven the need for more powerful powerplants in U.S. combat aircraft. The windtunnel, designed to explore the performance of propulsion systems, including ramjet and turbojet for both aircraft and missiles, will put the U.S. well ahead in powerplant progress, they said. The Tullahoma presentation was by F. L. Wattendorf, technical advisor, USAF; John Noyes, project engineer, Sverdrup and Parcel, Inc., consulting engineers; and A. I. Ponomareff of Westinghouse Electric Corp. A scale model of the windtunnel was flown to Los Angeles for the meeting.

▶ **Ramjet Future**—J. W. Braithwaite, assistant chief aerodynamicist at Mar-

ITALIAN SAGITTARIUS JET

Three-view drawing details characteristics of new Ambrosini Sagittarius which is powered by a nose-mounted 900-lb.-thrust Turbomeca Marbore. Earlier pictures (Aviation Week Apr. 27, p. 9) showed a single-place cockpit layout; these drawings suggest the craft can also be used as a two-placer. Note the sharply swept wings and conventional landing gear with a tailwheel.

IT'S AEROPROPS - FOR TURBOPROPS!

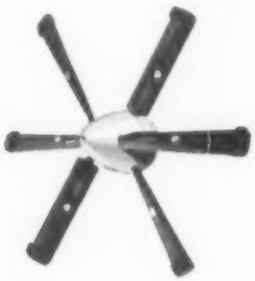


Powerful Allison Team Used in all Four U. S. Turbine-Propeller Planes

Turbine-driven propellers solve many urgent needs for truly high performing aircraft. They provide the answer to the desired combination of heavy payload, higher speed and longer range. Yet turbine engines, plus propellers, permit take-off and landing from shorter runways.

Out in front and pioneering to prove the place of turboprops in today's *and tomorrow's* aviation spectrum are three U.S. Navy aircraft powered with six-bladed contra-rotation Aeroprops and Allison T40 twin turboprop engines.

Serving with all three is America's only commercial-type turbine transport—the Allison Turboliner. Equipped with Aeroprop four-bladed propellers and Allison turboprop engines, it is General Motors' contribution to the proof-testing of turbines and propellers in a broad band of military and commercial aircraft applications.



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MILLIONS OF HOURS TO

DEVELOP THE J-57 TURBOJET

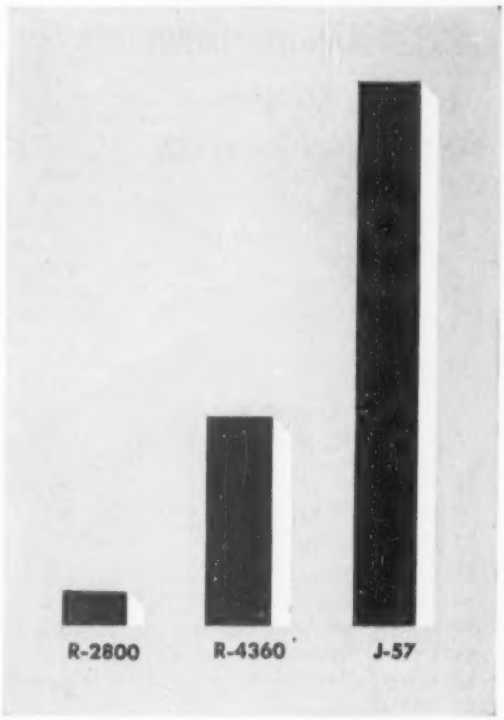
Models and mockups of detail parts and assemblies aid development engineers in design improvement work.

Since World War II, the aircraft industry has gone through a technical revolution. Advanced turbojet engines now provide aircraft with flight capabilities considered fantastic only a few short years ago.

But many men, even those close to aviation, do not appreciate the vast effort needed to fulfill the promise of truly great engine performance inherent in these turbojet designs.

As just one measure of that task, take the engineering effort required to bring Pratt & Whitney Aircraft's mighty J-57 turbojet to its present stage of development. So great were the technical problems that almost three times as many design and development man-hours were needed for the J-57 as for the world's most powerful aircraft piston engine, the 28-cylinder R-4360 Wasp Major . . . and almost *fifteen times* as many man-hours as for the R-2800 Double Wasp, one of the most powerful piston engines of World War II.

While design and development time is only one phase of jet engine production, it illustrates an entire industry problem. It also helps demonstrate why—today as always —*dependable engines take time to build.*



The above chart illustrates the tremendous increase in design and development man-hour requirements from the 18-cylinder R-2800 Double Wasp piston engine to the mighty axial-flow jet, the J-57. Design and development is, of course, only one phase in engine production. But the relationships illustrated here are typical of all phases of manufacturing the advanced, complex aircraft engines required today.

Pratt & Whitney Aircraft

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quardt Aircraft Co., told of difficulties encountered with ramjet engines, but stressed his belief in a brilliant future for the ramjet.

Describing the ramjet as a logical extension of present aircraft powerplants for highspeed propulsion, Braithwaite noted that it is at its most efficient performance above Mach 1.5. One problem arises, he told the session, from the fact that either too-rich or too-lean mixtures can cause flameout in a ramjet. The altitude at which both types of mixture come critically close together is uncomfortably close to design altitude, he said.

Maj. Charles E. Yeager, USAF, in an "off-the-cuff" speech at an American Rocket Society luncheon during the convention, described his experiences as pilot of rocket-propelled aircraft such as the X-1. Two technical sessions also were held under the auspices of the rocket society.

Aviation safety received prominent attention. Among the speakers were Sidney D. Berman, chief civilian aeronautical consultant and accident investigator from the Directorate of Flight Safety Research at Norton AFB, Calif. He discussed typical accidents and investigations.

Navy Contracts

The following contracts were announced recently by the Navy's Aviation Supply Office, 700 Robbins Ave., Philadelphia 11.

Parker Appliance Co., 17325 Euclid Ave., Cleveland, valves, fuel for P2V-5 aircraft, $89,439.

Presto Beverage Corp., 834-838 Sterling Pl., Brooklyn 16, N. Y., dye marker, $25,124.

Radio City Products Co., Inc., 152 W. 25th St., New York, frequency meter, 214 each, $105,049.

Reliance Chemical Co., Lee Terminal, Standiford Field, Louisville, Ky., thinner, cellulose nitrate dope & lacquer, 50,000 gal., $41,350; thinner, cellulose nitrate, 45,000 gal., $33,165.

Rinshed-Mason Co., 5935-5971 Milford Ave., Detroit, enamel, 48,696 gal., $111,027.

Rochester Products Div., General Motors Corp., 1000 Lexington Ave., Rochester, N. Y., regulators, automatic, manifold pressure, 222 each, $69,687.

Rollan Co., Route 1 & Camp Meeting Road, Topsfield, Mass., microphone, 12,000 each, $47,535.

Rohm & Haas Co., Plastics Dept., 222 W. Washington Sq., Philadelphia, plastic, $37,-170.

Safe Flight Instrument Corp., 4 Water St., White Plains, N. Y., detector, 478 each, $43,020.

Scintilla Magneto Div., Bendix Aviation Corp., Sherman Ave., Sidney, N. Y., maintenance parts, used on pumps, distributor & magneto assy, for various engines, $75,274.

Seaboard Electric Co., 417-421 Canal St., New York, flasher, position lights, 1,978 each, $85,028.

George Senn, Inc., 2200 E. Westmoreland St., Philadelphia, thinner, synthetic, enamel and lacquer, clear, $26,538.

Shell Oil Co., 50 W. 50th St., New York, fuel, additive (special), 18,860 gal., $38,750.

Slote & Klein Inc., 930 Newark Ave., Jersey City 6, N. J., helmet, 10,740 each, $53,915.

Sperry Gyroscope Co., div. of Sperry Corp., component parts for various aircraft, $269,699; test equipment, $27,783; unit power control for various aircraft, 192 each, $31,814.

Telectro Industries Corp., 35-16 37th St., Long Island City 1, N. Y., electrical outlet box, 975 each, $54,600.

Texas Instruments Inc., 6000 Lemmon Ave., Dallas 9, parts, network, 355 each, $38,322.

M. Ten Bosch Inc., Pleasantville, N. Y., tester, line maintenance, used on amplifier, 800-0100; altitude controller 800-0200, 62 each, $83,951.

Vickers, Inc., 1400 Oakman Blvd., Detroit 32, relief hydraulic valve, 152 each, $42,070; accumulator, 59 each, $26,733.

Victory Apparel Mfg. Corp., 250 Passaic St., Newark, N. J., preserver, life, adults, 42,600 ea., $217,047.

Waukesha Motor Co., Railway Div., 1945 Jay-Vee Drive, Waukesha, Wis., maintenance parts for ground units, $30,783.

Western Design & Mfg. Corp., 220 N. Front St., Burbank, Calif., unit power, for R6D aircraft, 61 each, $52,227.

Western Hydraulics, 10918 Burbank Blvd., N. Hollywood, Calif., valve, hydraulic for P2V-5, -6 aircraft, 160 each, $77,471.

USAF Contracts

Following is a list of recent USAF contracts announced by Air Materiel Command.

Champion Spark Plug Co., 900 Upton Ave., Toledo, aircraft spark plug, 240,000 ea., $729,600.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., true airspeed indicators, 252 ea., $210,450.

Electric Storage Battery Co., Philadelphia, battery, aircraft storage, 9,000 ea., $390,150.

Fairchild Engine & Airplane Corp., Fairchild Aircraft Div., Hagerstown, Md., kits for aircraft, $201,435.

Gould-National Batteries, Inc., Depew, N. Y., battery, aircraft storage, 9,000 ea., $390,150.

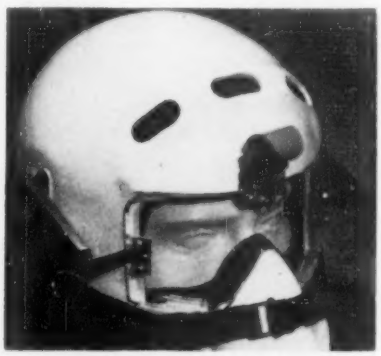
Kollsman Instrument Corp., 80-08 45th Ave., Elmhurst, N. Y., airspeed indicator, 252 ea., $108,244.

Radio Corp. of America, RCA Victor Div., Camden, N. J., radio set, $4,000,000.

Raytheon Mfg. Co., Power Tube Div., Waltham, Mass., magnetron tube, 250 ea., $196,875.

Bell Sound Systems, 555 Marion Rd., Columbus, Ohio, preamplifier strip, 94 ea., 78 ea., $31,356; mounting MT-622A/APW-11 (install) 1,599 ea., spares, 403 ea., $132,280.

Charles Beseler Co., 60 Badger Ave., Newark, N. J., projector, case, carrying mask, master cellophane roll, $25,716.



SLOTS FOR SAFETY

New helmet designed for emergency escapes from planes flying at supersonic speeds has slots cut in crown to reduce windshock and prevent headgear from being torn from pilot's head. Helmet was developed by Douglas Aircraft Co. for Air Research & Development Command.

ARO AIR TOOLS MEAN *faster assembly* for DOUGLAS AIRCRAFT

LONG BEACH DIVISION

DRILLING—Mr. Kenneth Hull, Tool Engineer at Douglas, Long Beach, inspects operation of Aro Right Angle Drill for close-corner work.

DRILLING—Aro Aircraft Drills speed production . . . models range from 500 to 17,000 R.P.M.

•

SANDING—Aro Vertical Sander smooths weld seams rapidly. High power in proportion to weight.

These are typical of hundreds of assembly jobs performed by ARO Air Tools in the Douglas Aircraft plant at Long Beach, Calif.—to meet demands for *high speed, efficient* production!

Do you have similar production problems in screwdriving, nutsetting, grinding, sanding, drilling, mixing, etc.? An ARO Field Engineer will gladly help in engineering your job or *contact your Aro distributor.*

The Aro Equipment Corporation, Bryan, Ohio

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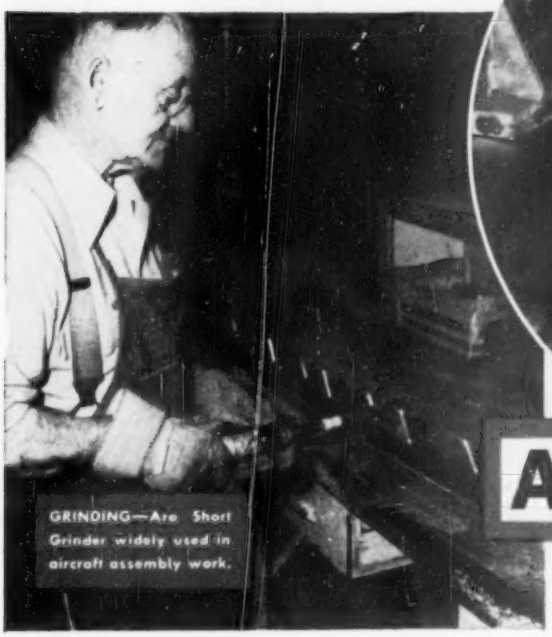

GRINDING—Aro Short Grinder widely used in aircraft assembly work.

ARO AIR TOOLS

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CHEMICALS — PLASTICS

SERVING INDUSTRY...WHICH SERVES MANKIND

Cessna Aircraft Corp., Wichita, procurement of Phase I development of Model 318 airplane, $700,000.

Collins Engineering Co., 9050 Washington Blvd., Culver City, Calif., cap assy., fuel tank filler, $17,314 ea., $30,126.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., indicator, attitude gyro, 4,072 ea., 328 ea., 598 ea., $3,882,118.

Elwood Pattern Works, Inc., 125 N. East St., Indianapolis, rack, 1,000 ea., $37,150.

General Electric Corp., 1 River Rd., Schenectady, N. Y., generators, 102 ea., $94,789.

Gill Electric Mfg. Co., Redlands, Calif., battery, aircraft, storage, 900 ea., 600 ea., $63,411.

B. F. Goodrich Co., 803-4 Winters Bank Bldg., Dayton, wheel, main, 2,169 ea., 2,287 ea., brake, main, 7,146 ea., $6,492,843; wheel assy., nose, 204 ea., 167 ea., 165 ea., $63,234.

Gould-National Batteries, Inc., Depew, N. Y., battery, aircraft storage, 900 ea., 600 ea., 900 ea., 60 ea., $116,496.

Hartman Electrical Mfg. Co., 175 Diamond St., Mansfield, Ohio, relay, aircraft generator, 1,691 ea., relay, 3,390 ea., 1,204 ea., $100,517.

Jack & Heintz, Inc., 17598 Bway., Cleveland, generator, electric tachometer, 3,458 ea., $78,047.

Kearfott Co., 1150 McBride Ave., Little Falls, N. J., type V-7A indicators, 4,895 ea., $1,006,220.

Lackner Co., Inc., Lackner Bldg., Cincinnati, cabin pressure indicator, 9,924 ea., $385,555.

Pacific Div., Bendix Aviation Corp., 11600 Sherman Way, N. Hollywood, Calif., bladder assy., 1,000 ea., cam, 60 ea., piston, 20 ea., $25,257.

Transport Products Corp., 3008 Magazine St., Louisville, Ky., relay, overvoltage, 3,790 ea., $47,246.

Warner Div., Detroit Harvester Co. of N. Y., Inc., 21535 Groesbeck Highway, Detroit, control assy., brake, 52 ea., valve assy., brake, 62 ea., $42,143.

Webster-Chicago Corp., 5610 Bloomingdale Ave., Chicago, components of AN/ARA-26, $137,175.

S. S. White Dental Mfg. Co., Industrial Div., 10 E. 40th St., New York, shaft, tachometer drive, 9,759 ea., $33,375.

Bendix Products Div., Bendix Aviation Corp., South Bend, Ind., wheel assy., 58 ea., brake assy., 58 ea., 35 ea., $114,136.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., regulators, Type L-4, 1,653 ea., 870 ea., 743 ea., $1,074,413.

Goodyear Tire & Rubber Co., Inc., 1144 E. Market St., Akron, wheel assy., 120 ea., 90 ea., 60 ea., $152,669.

Jack & Heintz, Inc., Cleveland, starters, 173 ea., data, $81,420.

Kindred Aviation Co., 3519 Pacific Ave., Burbank, Calif., crankshaft assy., 10 ea., cylinder assy., 70 ea., $32,500.

Kollsman Instrument Corp., 80-08 45th Ave., Elmhurst, N. Y., machmeters, Type A-2B, 368 ea., $1,758,423.

Leland Electric Co., Div. of American Machine & Foundry Co., 1501 Webster St., Dayton, phase inverters, 224 ea., $74,963.

Lewis Engineering Co., 339 Church St., Naugatuck, Conn., temperature indicator, 1,150 ea., 7,584 ea., $334,284.

Paragon Electric Co., 1600 12th St., Two Rivers, Wis., Type F-1 solenoid, fuse arming, 82,804 ea., $133,205.

Pesco Products Div., Borg-Warner Corp., 24700 N. Miles Rd., Bedford, Ohio, motor assy.-pump prop, 256 ea., 28 ea., data, $34,641.

Square Root Mfg. Corp., 391 Saw Mill Road, Yonkers, N. Y., filter control assy., $131,832.

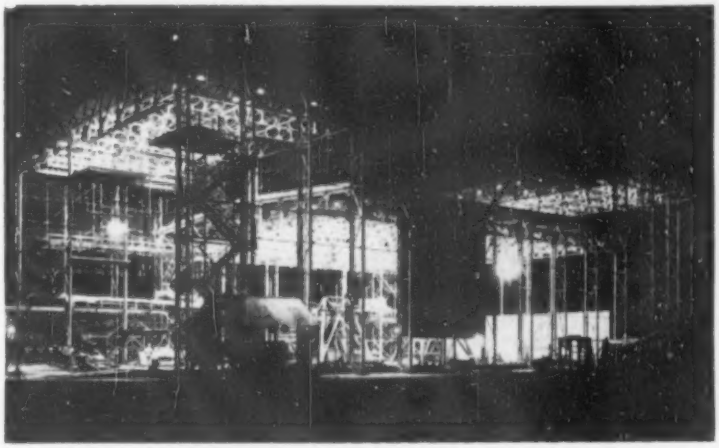
Sylvania Electric Products, Inc., Radio & Television Div., 254 Rano St., Buffalo, N. Y., radio receiver, 2,052 ea., radio transmitter, 1,958 ea., power junction box, 1,958 ea., $3,461,285.

U. S. Gauge Div., American Machine & Metals, Inc., Sellersville, Pa., pressure transmitter, 282 ea., 282 ea., engineering data, $64,716.

Aero Instrument Co., 5105 Denison Ave., Cleveland, pitot tube, 6,297 ea., $102,011.

AC Spark Plug Div., General Motors Corp., 1300 Dort Highway, Flint, Mich., aircraft spark plug, 1,305,836 ea., $4,570,426.

Aviation Week Picture Brief



UNDER LIGHTS New static test facility at Convair San Diego seen here in night operation. Siding is of Plastiglass.

Convair Flying Boat Test Dock

A huge static-test facility for checking flying boat structures is operating at Consolidated Vultee Aircraft Corp.'s San Diego Div.

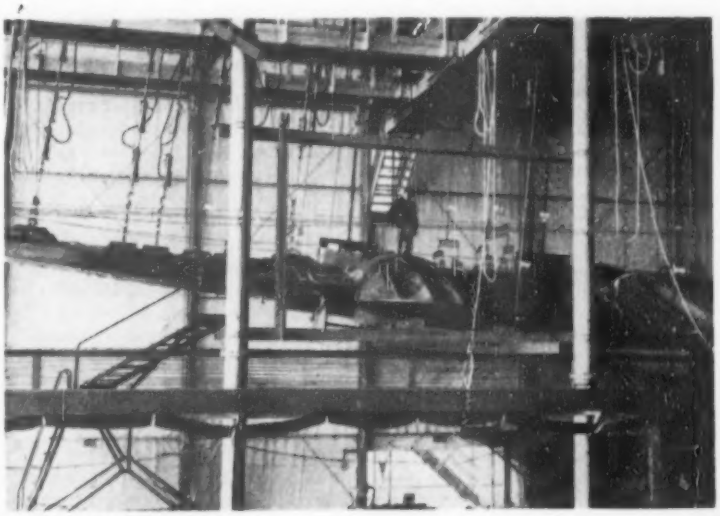
The facility's equipment can apply loads ranging from 60,000 to one million pounds, from any direction and can divide any single load into as many as 200 application points.

In a recent R3Y wing test, 3,000 sponge rubber pads measuring 5x5 in. were glued to the airfoil surface. These, plus a "whiffletree" arrangement distributing the load applied by hydraulic jacks, were used to duplicate accurately the operations forces likely to be encountered.

Another test scheduled shortly for the new facility will be on the R3Y's pressurized hull. Eleven different loading tests will be run in a checkout under simulated flight at 30,000 ft.

The test area is constructed on a 3-ft.-thick concrete foundation spreading over 19,600 sq. ft. Maximum height of the test structure is 67 ft., with ceiling heights of 56 ft. and 35 ft. available in different bays. Enclosure for the structure is a Plastiglass siding.

A separate building houses recording equipment and space for engineering personnel.



UNDER LOAD wings can be tested to destruction at Convair test facility. Catwalks enable personnel to get to test apparatus.

Darnell
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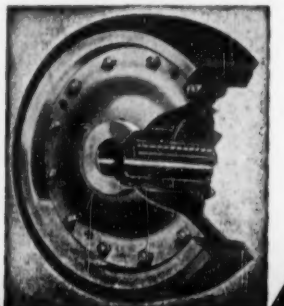


Airline Dividend Record and Forecast

(On a Per-Share Basis)

Carrier	Calendar Years 1953*	1952	1951	1950	1949
American—Common	$0.50	$0.50	$0.50	$0.25	None
" —Preferred	3.50	3.50	3.50	3.50	$3.50
Braniff	None	None	0.50	0.25	None
Capital	None	None	None	None	None
Colonial	None	None	None	None	None
Continental	0.50	0.50	0.50	0.25	None
Delta—C & S[1]	1.00	1.00	0.50	0.50	None
Eastern	0.50	0.50	0.50	0.25	None
National	0.55	0.50	0.25	None	None
Northeast	None	None	None	None	None
Northwest—Common	None	None	None	None	None
" —Preferred	1.15	1.15	1.15	1.15	1.15
Pan American	0.50	0.50	0.50	0.25	0.25
TWA	None[2]	None	None	None	None
United—Common	1.50	1.50	1.50	0.75	None
" —Preferred	4.50	3.00[3]	...	...	...
Western	0.60	0.60	0.50	None	None

* Author's estimate.
[1] Experience of Delta only prior to 1953.
[2] Paid 10% in stock in January 1953.
[3] Present series issued March 1952.

Airline Investors Want Dividends

Carrier stocks previously sold on growth appeal: now buyers are looking for regular cash payments.

In placing its common shares on a regular quarterly dividend basis National Airlines has taken a long step forward in creating an atmosphere of improved stability for its own company and that of the industry as a whole.

In the recent past, cash disbursements to airline stockholders have been of a sporadic nature with no encouragement given of any regular schedule of payments. But this was characteristic of an industry constantly expanding and requiring almost continuous reinvestment of earnings. Airline equities held their big attraction in the growth qualities of the industry and the hope that someday a rising earnings curve would establish a degree of financial substance.

▶ **Less Tolerance**—The industry has experienced a tremendous growth and continues to expand with no saturation of its potential yet in sight. While the bulk of available earnings has been "plowed back" and facilitated the acquisition of augmented properties, investors no longer have the same tolerance as before toward irregular and limited dividend payments.

In the first place, the air transport industry has attracted a broader and more diversified group of investors who do not have the same patience in understanding the basis for postponing income disbursements as do the more "sophisticated" investors and speculators who first supported airline securities because of the capital gains prospects. This condition becomes particularly pronounced when a wide selection for investment prevails among broad industrial groups affording attractive prospects in earnings and dividends.

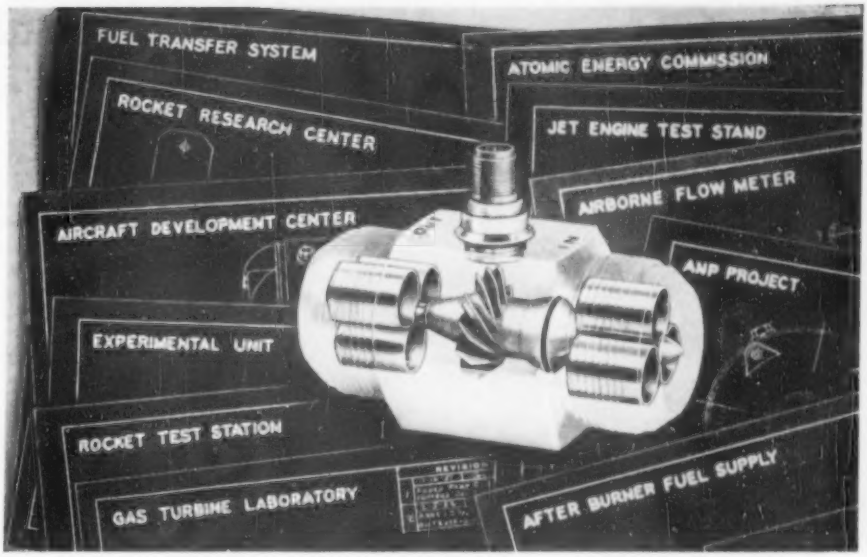
As long as capital demands in the air transport industry continue heavy, equities of the group must compete for investment consideration among other industrial situations which have many attractions of their own. For this reason the airlines are faced with the necessity of providing a larger measure of income return than has prevailed in the past if improved investment stature is to be attained.

▶ **Favorable Impression**—An excellent means of warming the hearts of stockholders is regular, quarterly cash disbursements. They then receive at least four tangible demonstrations during the year of the company's progress, all serving to create a cumulative favorable impression.

In moving to a stated regular quarterly dividend basis, National has thus taken a constructive action. The company declared two quarterly dividends of 15 cents each on its common stock payable July 14 and Oct. 5, respectively.

This is an increase, as it indicates an annual dividend rate of 60 cents as against the preivous semi-annual dividend basis paying 50 cents a year. The initial 25-cents-per-share disbursement was made in July 1951.

▶ **Industry Record**—Other airlines who have been and continue on a regular



This unique flow sensing element, able to withstand high pressures and high or low temperatures, has brought a new standard of accuracy to flow measurement in test and research work. Resistant to highly corrosive liquids, it is also being used in most jet and rocket test projects.

Potter Flowmeter First in Research

▸**Research Installations** throughout the United States and Canada have adopted the Potter Flowmeter as their standard for accuracy. Simplicity, stability, dependability, and ruggedness, combined with an ability to operate in either the vertical or horizontal position are only a few of the features that have caused leading aircraft research organizations to specify Potter for all new test installations.

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Twenty-eight inch rotating disc scale gives Potter-Brown Flow Indicator superior legibility.

▸**Engine Test Cells** have standardized on Potter for *safety* as well as ease of installation, wide rangeability and accuracy. The Potter sensing element is inherently explosion proof, unbreakable, and has no gaskets, pressure seals or stuffing box. The electrical output is too low to cause a spark under any possible conditions.

▸**Accurate Reading** of flow rates has been made possible through the development of instruments whose precision approaches the Potter sensing element. The Potter-Brown Precision Flow Indicator has a scale with a graduated length of 28 inches, marked with as many as 500 divisions. Since the flowmeter is linear, legibility is excellent at high or low flow rates. If necessary, the effective scale length can be *doubled* by using a dual scale.

▸**Recording Flow** on either a circular or strip chart provides permanent test records. The Potter-Brown Strip Chart Recorder, having a graduated chart width of ten inches and available in a variety of chart speeds provides accuracy, convenience, and ease of reading.

▸**Top Secret** labels are on many of the projects in which Potter equipment is being used; but most users are able to give reports on the operation of their Potter Flowmeters. If you are measuring flow, and you're not already using the Potter Flowmeter, ask your associates and acquaintances in the industry about this new method of measuring flow. Their experience may help you to solve your flow measuring problems.

▸**For Further Information.** State whether you are interested in indicating, recording or controlling flow rate. Specify if you require airborne equipment. Write to:

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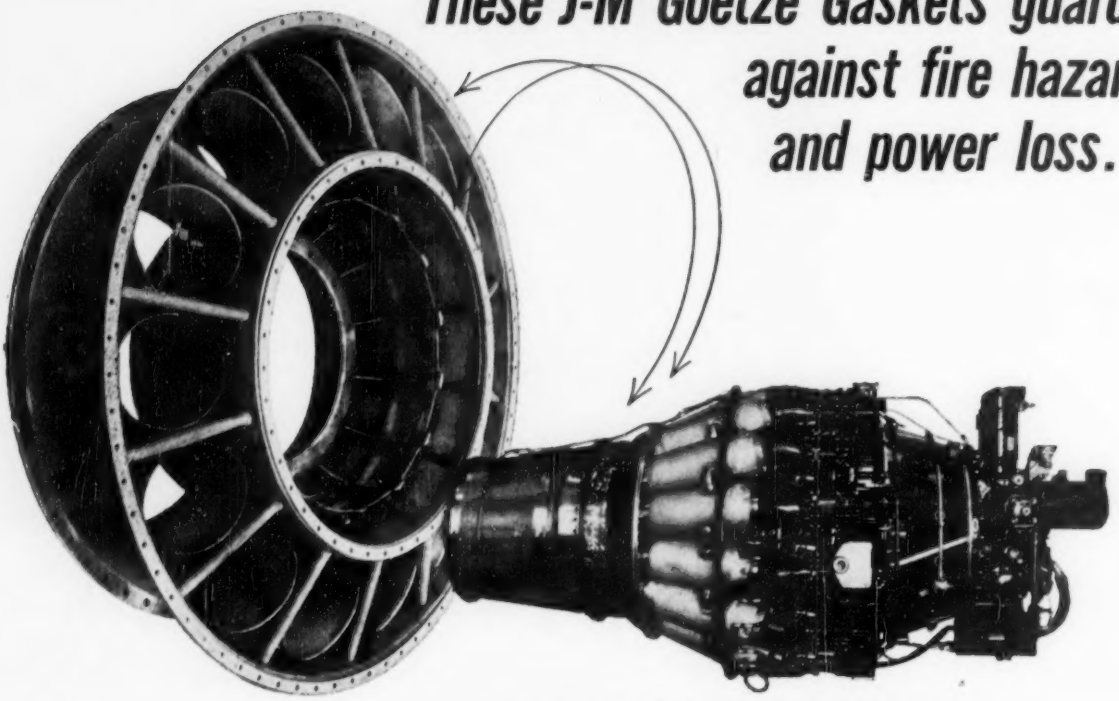

Arrows point to J-M Goetze metallic gaskets on the inner and outer annulus, and their approximate location on the J33 turbojet engine turbine frame.

...on powerful turbojet engines like the J33

Sealing the inner and outer annulus on the J33 to prevent leakage of fuel and flame into the airframe is another example of the many tough, critical sealing jobs entrusted to Goetze custom-crafted metallic gaskets.

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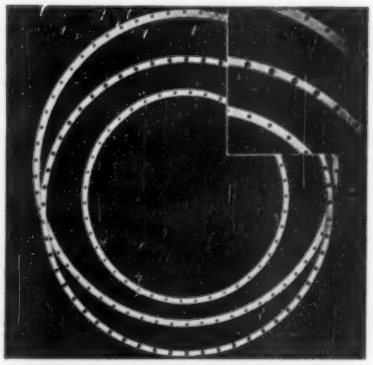
There is a Johns-Manville Goetze gasket for practically every jet aircraft requirement. Goetze craftsmen can fabricate them in almost any shape or size for sealing igniters, compressor bleed-offs, cross ignition tubes, combustion chambers, fuel nozzles, turbine drain lines, etc. Backed by more than 60 years of Goetze "know-how," these durable gaskets are solving many of industry's most complex sealing problems.

Why not write for further information about Johns-Manville Goetze gaskets... and other J-M flight-proved products for the aviation industry. Ask for your copy of Brochure AV-1A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.



Close-up of J-M Goetze metallic gaskets used as inner and outer annulus gaskets on jet engine turbine frame.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PRODUCTS for the AVIATION INDUSTRY

quarterly dividend basis include United, Delta, Western, and Continental. United has been paying 25 cents quarterly since early 1952 and paid an extra 50 cents at the year-end.

Semi-annual dividend payment policies remain in effect on the common stock issues of American, Eastern, and Pan American World Airways.

The table on page 44 reveals the record of all cash dividend disbursements of the U. S. trunk airlines since 1949, with the total of 1953 estimated.

The carriers previously mentioned have all been on some dividend basis since at least 1951 and, in most cases, back to 1950. Carriers not now making cash disbursements are Braniff, Capital, Colonial, Northeast, Northwest (common stock), and TWA.

Of this latter group, Capital has the best prospect of initiating cash payments on its stock. Its recent earnings have shown consistent gains, but heavy capital expenditures preclude immediate dividend payments. Colonial has never paid a cash dividend and its prospects of doing so are remote in its present corporate existence.

All dividends due on the preferred stock issues outstanding and issued by American, Northwest and United are being paid when due. In fact, with the exception of the preference stock of Northwest, which ultimately made good all payments due, the dividends on the senior equity issues of these carriers have been paid on schedule from their very inception, even during periods of adverse earnings. This has made for a good credit record. Northeast, which was temporarily in abeyance on its preferred dividend payments, recently cleared all arrearages.

▶ **No Rise Seen**—Cash dividends for the domestic trunks for 1953, interestingly enough, are not expected to exceed the aggregate of some $12.6 million paid to stockholders during 1952.

The increased capitalization of United and the attendant cash dividend requirements are more than offset by the elimination of about $382,000 paid to Chicago & Southern stockholders last year. (In place of the C&S equity there has appeared $10.7 million in 5% debentures issued by Delta-C&S, which require annual interest servicing payments of $535,000.)

For all the carriers, a formidable item to be absorbed by operation is interest on debt.

Nevertheless, the undertone of stability "creeping" into the air transport industry through the form of regular dividend disbursements is a constructive development. This further highlights the necessity of maintaining profitable operations with sustained earnings so that reasonable dividend payments can be made to promote a healthy industry. —Selig Altschul

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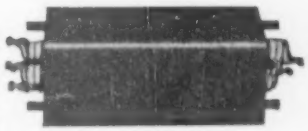

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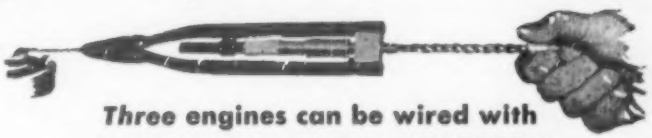

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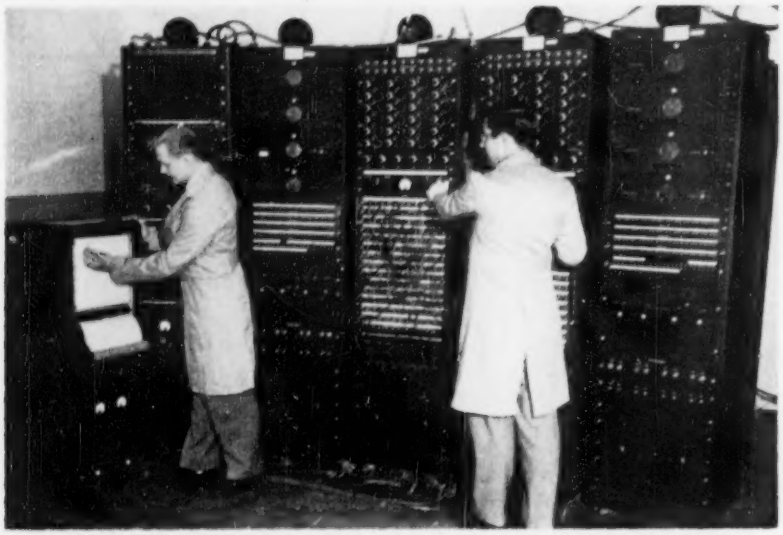
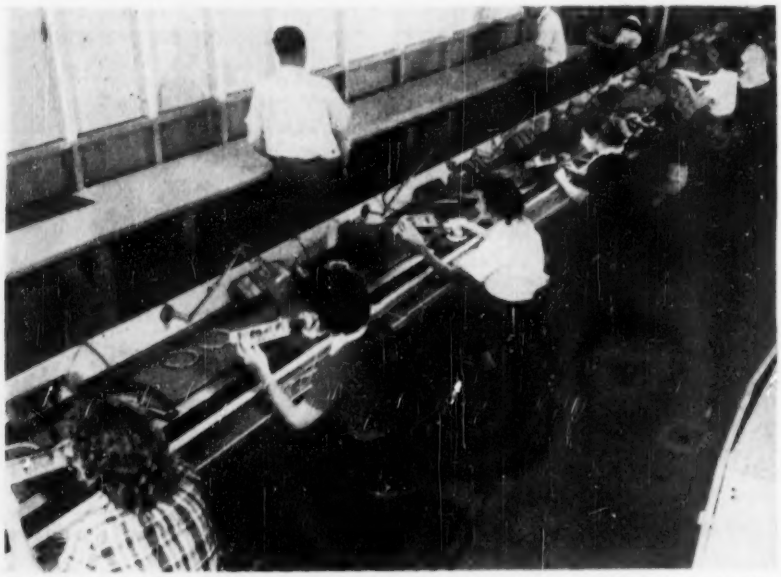


RESEARCH ENGINEERS solve problems in design of electronic brains for aircraft.



ASSEMBLY LINES produce avionic units to be used in guidance equipment for missiles.

NAA Builds Expert Avionics Team

By Philip Klass

Downey, Calif.—North American Aviation, Inc., a major power in the aircraft industry, has assembled a staff of avionics experts which could make it a major power in the electronic industry.

NAA's avionics potential and growth has been obscured by its highly classified missile guidance and control work, and has been overshadowed by the phenomenal growth of its neighbor, Hughes Aircraft Co. (AVIATION WEEK May 25, p. 14; June 29, p. 44).

▶ **Expansion Possibility**—North American's president, J. L. Atwood, says the company has no present plans to expand its avionics activities or facilities beyond what is needed to support its own missile and airframe programs.

However, Atwood doesn't slam the door to the possibility of NAA moving outside the airframe and missile business, even though he feels that aircraft company management have their hands full with airplane development problems.

Asked about the possibility of North American applying its servo mechanisms and digital computer know-how to industrial fields (a step which Hughes Aircraft Co. is eyeing), Atwood told AVIATION WEEK that NAA's engineers "would be well equipped for such activities . . . it is a possibility."

The report that NAA has been advertising for industrial marketing analysts may indicate that Atwood and North American have plans which they aren't yet ready to talk about.

▶ **Big, But How Big?**—For security and possibly competitive reasons, NAA won't disclose the number of professional scientists and engineers in its avionics group—called the Electro-Mechanical Engineering Dept.

A company official says that the E-M engineering group is one of four major departments in the Missile and Control Equipment Division which employs approximately 4,000 persons in research and development. The majority of these, the official says, are engineers or technicians.

Dr. N. E. Edlefsen, who directs the E-M engineering group, says the number of its professional scientists and engineers is comparable to that of the Hughes Research and Development Labs (currently more than 1,200).

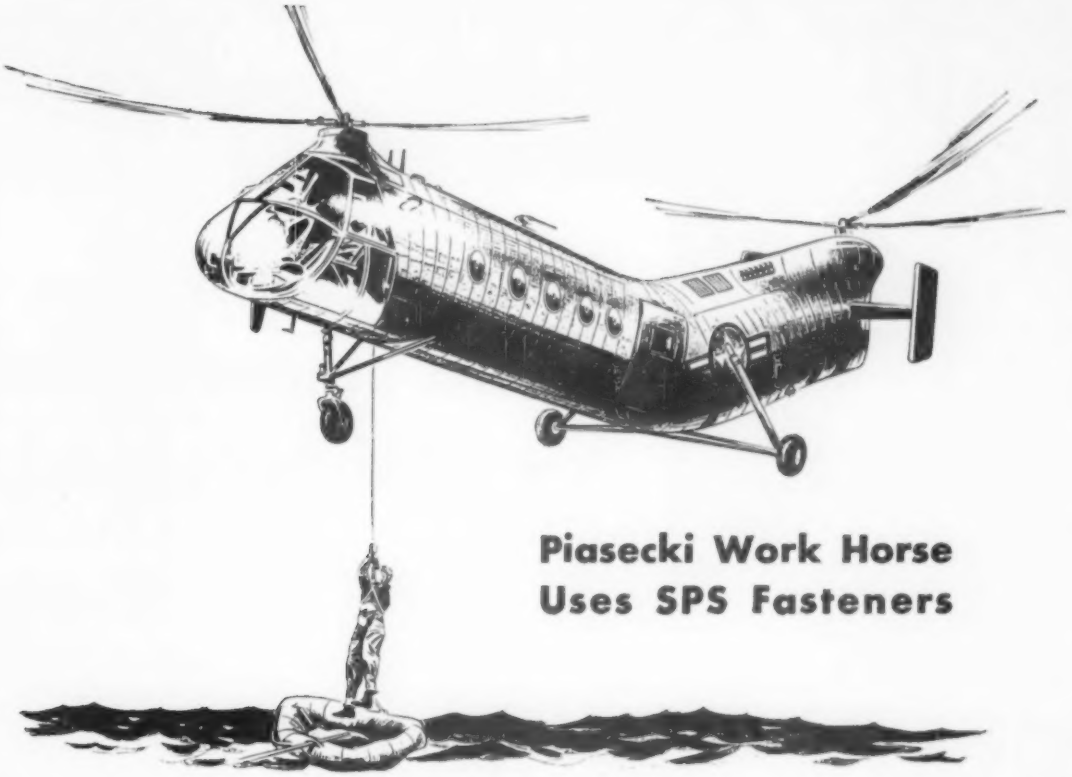
▶ **Compared With Hughes**—Comparison of North American's E-M engineering department with the Hughes R & D Labs may be odious to NAA, but it is quite logical. Both moved from aircraft into avionics via missile contracts at about the same time (1947). The control and guidance problems associated with their missiles forced both companies to assemble large avionics staffs.

A major difference between the two companies is that Hughes moved into the interceptor fire control field in 1948, which has since developed into a $150-million-a-year production item. North American entered this fire control field only a couple of years ago and its activities at present are limited to development.

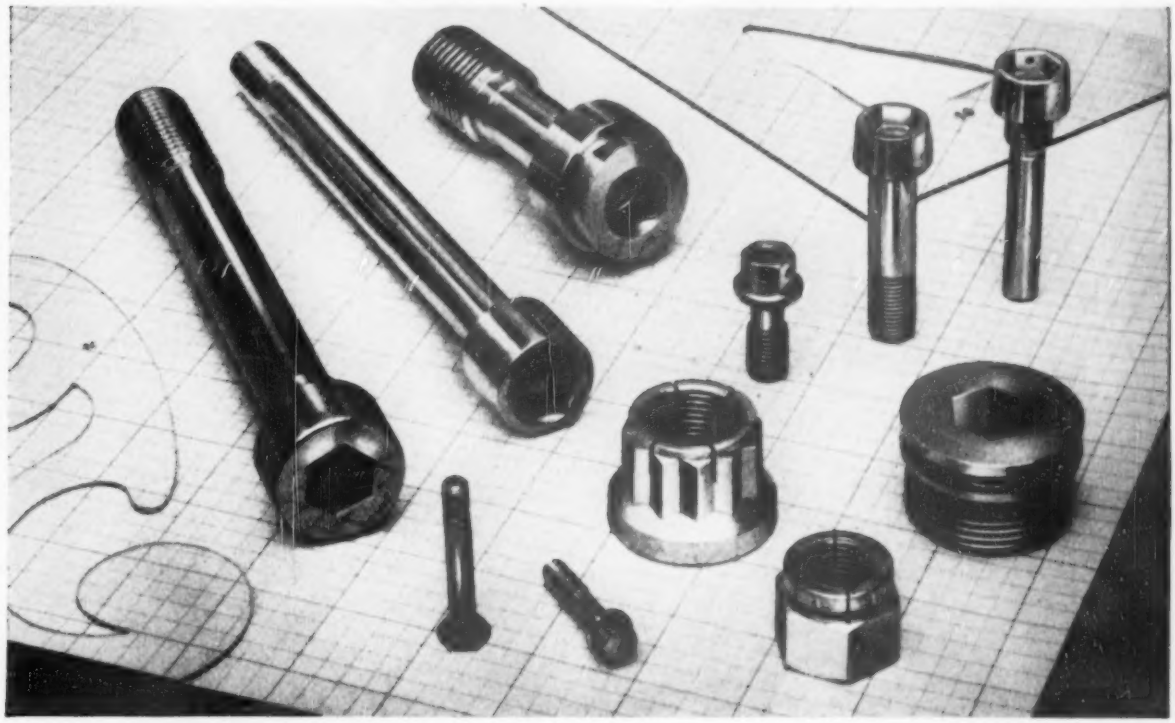
NAA doesn't talk about the status of its long-range missile program for security reasons, but a visitor gains the impression that there is not yet any large-scale production of avionics equipment for the program. Thus North American still faces the hurdle and headaches of setting up and starting production on complex avionics equipment.

North American is getting some experience via pilot-production lines on some avionics equipment. One such system was described as being "of comparable complexity to an airplane yaw damper system."

▶ **Advanced Fire Control**—NAA is de-



Piasecki Work Horse Uses SPS Fasteners



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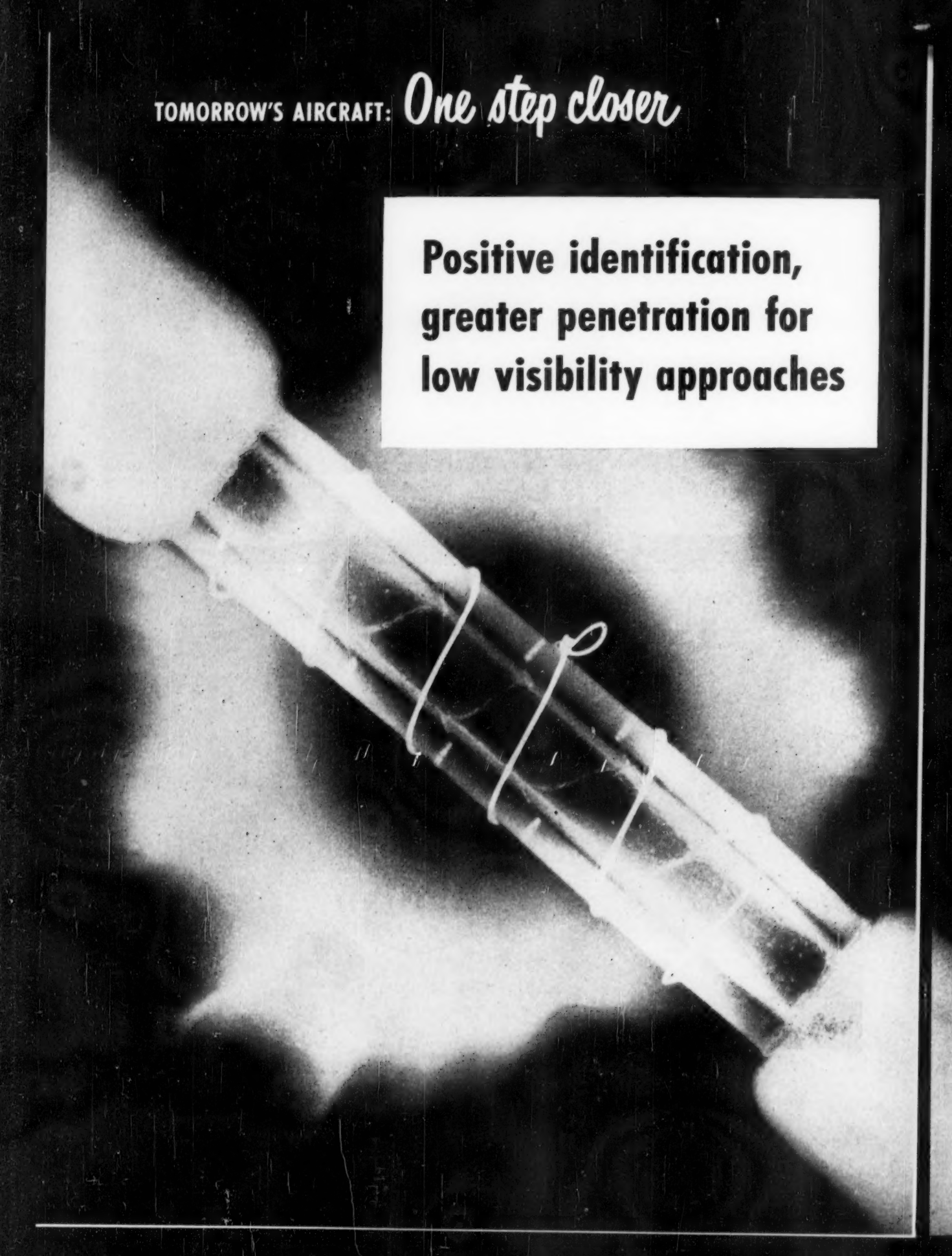

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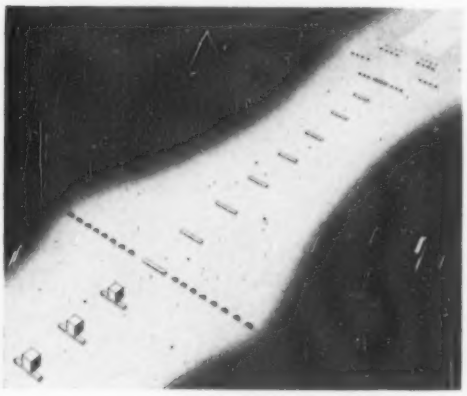

The Krypton Flash unit is shown at left with the tubular Krypton lamp in place. The flash lasts only 17 microseconds and is too short in duration to have a blinding effect on pilot. Spread is about nine degrees. A lower step of brightness is provided for better visibility conditions. At right is a typical approach pattern where the Krypton Flash units are superimposed on a single-row, center-line system of steady burning lights.

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veloping an advanced interceptor fire control system for the USAF and doing some similar work for the Navy Bureau of Aeronautics. The Air Force is expected to watch the results of this program closely to see whether it gets a better weapon when the airframe and fire control are designed by a single manufacturer (AVIATION WEEK Mar. 24, 1952, p. 17).

Asked about the report that this system would make widespread use of magnetic amplifiers, Dr. Edlefsen said that they would be used instead of vacuum tubes wherever feasible but added that mag-amplifiers were "no panacea." Edlefsen says that the E-M group is stressing simplicity and ruggedness and is "pulling out tubes wherever possible." He predicts that the NAA fire control will be "superior to any existing system."

Edlefsen says NAA will not restrict the application of its fire control system developments to North American airframes. Several other aircraft companies have expressed an interest in the NAA systems and "we have been quite receptive," he points out.

▶ **Systems Engineers Needed**—The hardest part of designing fire control is what Edlefsen calls "systems development." This work requires men with broad experience in all contributing fields (radar, computers, flight control, tactics, etc.).

The difficulty, Edlefsen says, is that an engineer who is a radar expert, for example, is reluctant to make a new professional start in a computer or flight control group in which he is a "technical novice" at the beginning.

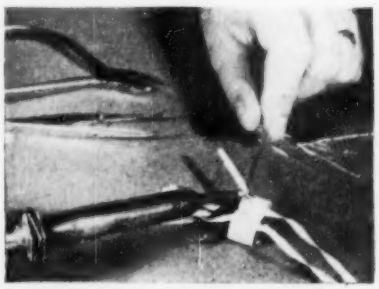
▶ **Airborne Digital Computers**—Generally speaking, North American thinks that digital-type computers are more flexible than analog-types for airborne navigation and fire control tasks. North American, like Hughes and others, is working in the digital computer field.

However, both Edlefsen and his second-in-command, John R. Moore, say that the choice between analog and digital depends upon the specific job to be done. Moore says that in some instances, a combination analog-digital computer may be the best solution.

▶ **Cautious on Transistors**—North American is putting considerable effort into studying the application of transistors to its avionic equipment but is moving cautiously in substituting them for vacuum tubes, Edlefsen says. The wide variation in characteristics between individual transistors and their past unreliability (due to inadequate sealing against moisture) are the reasons.

North American expects to have some transistorized sub-assemblies in production within a couple of years and is currently "debating whether to gamble on using them in a new computer design," according to Edlefsen.

BIRTH of NAA transformer: winding . . .



SOLDERING a lead onto equipment . . .

POTTING in resin to hermetically seal it.

NAA says it is also moving slowly in the use of sub-miniature tubes and components in tactical equipment, although there is much experimental working going on in sub-miniatures. The reason, again, is lack of sufficient sub-min component reliability.

▶ **Reactions**—Discussions with Edlefsen and Moore lead a visitor to conclude that they feel they have the technical know-how to become "another Hughes Aircraft" and are hoping for management backing to do just that.

However, discussions with Atwood leave the impression that NAA will move much more slowly and cautiously than Hughes did. One gathers that Atwood views NAA's avionics activities as a means to an end—better airplanes and missiles—and not as an end in itself.

FILTER CENTER

▶ **M-H Tests New Autopilot**—Minneapolis-Honeywell is testing its recently developed E-10 lightweight fighter autopilot on an F-94 bailed to it by the Air Force.

▶ **Hughes to Build New Overhaul Base**—Hughes Aircraft, which is currently operating a large modification and overhaul base for its fire control systems in Los Angeles, will soon establish a similar base in the East, a company spokesman says.

▶ **Bendix Demonstrates New GCA**—A new type of ground control approach radar system developed by the Bendix Radio Division of Bendix Aviation was recently demonstrated to 40 representatives of the Navy Dept., Marine Corps, and the Air Navigation Development Board, the company says. Details of the new GCA are classified but speculation is that the equipment is designed for carrier use.

▶ **Better Transistors Coming**—To eliminate transistor failures caused by moisture, the industry is fast switching to hermetically sealed units. Hermetically sealed junction transistors are reportedly available from CBS-Hytron and should be in production soon at Western Electric and Raytheon Manufacturing Co., according to spokesmen. Hydro-Aire is currently producing hermetically sealed point-contact transistors and Western Electric reportedly expects to be producing them by the end of the year.

▶ **RCA Explains Intercom Problems**—Problems which Boeing encountered with the new RCA low-noise A1C-10 intercom system in Wichita-built B-47s are attributed to stray pick-up in airplane cabling and a misunderstanding on system performance specs by an RCA spokesman. The low-impedance A1C-10 system requires more careful attention to cable runs, RCA says, and Boeing has rerouted its cabling to eliminate pick-up. Based on information from a Boeing engineer, this column on May 18 attributed the difficulties to the extreme sub-miniaturization used in the A1C-10. —PK

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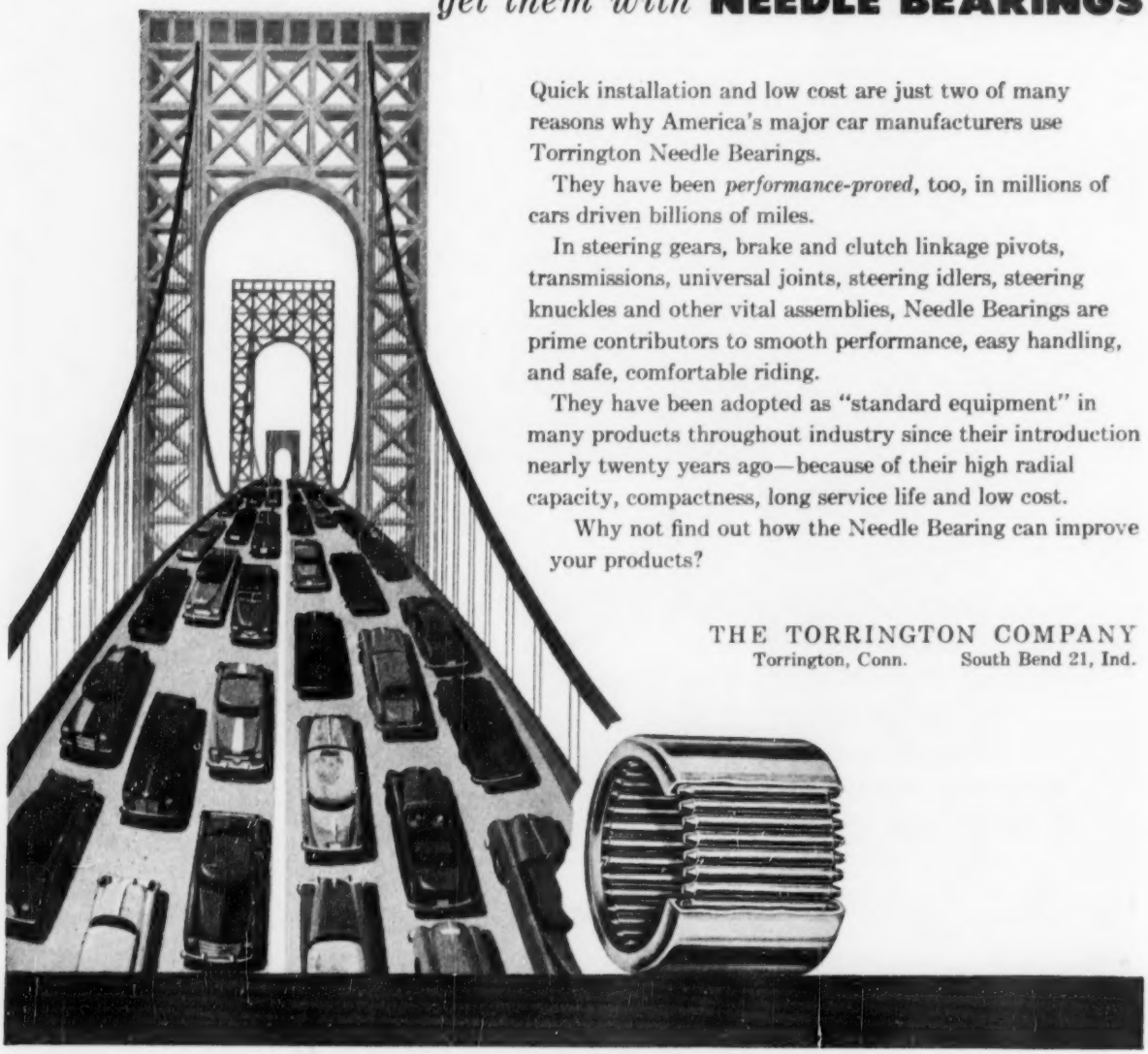

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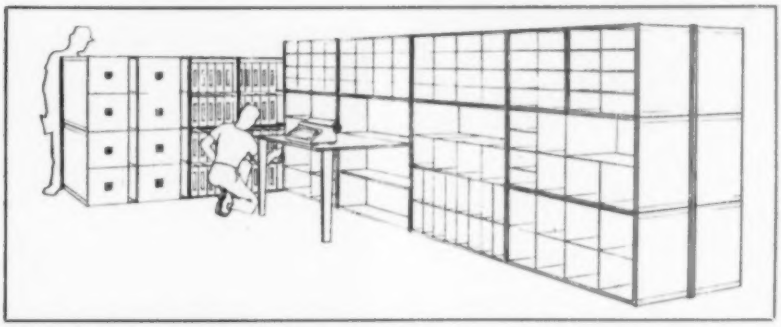
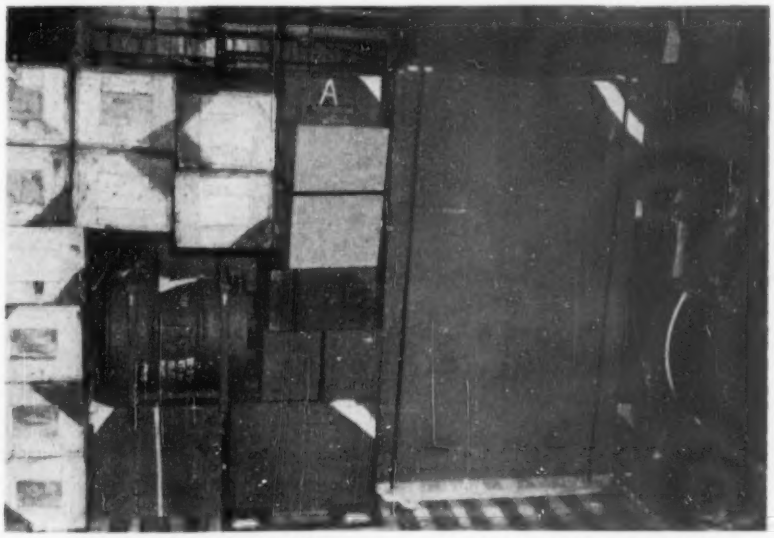
Trade Marks of 12 of the 18 passenger car manufacturers, all of whose cars enjoy the benefits of Needle Bearings.

STUDEBAKER · CHRYSLER · DODGE · Packard · DeSoto · WILLYS · Nash · KAISER · LINCOLN · Ford · MERCURY



FIELD DESK, bins and filing cabinets are made up from shipping boxes.



NEAT "UNITIZED" package (right) compares with old-style hodge-podge (left).

Air Units Can Live Out of Boxes

AF plans service trials of new containers that double as shipping packages and desks, bins, cabinets.

A simple container may hold within it the key to greater mobility and swifter deployment of Air Force units.

The security lid on this box was lifted recently during USAF exercises in England, showing how greatly it may simplify air wing supply and storage, packing and air transportability of equipment, and how it may narrow the gap between mobility of aircraft and of the impedimenta which sustains the aircraft.

▶ **Service Tests**—In a test alert movement of air units from the U. S. to England, the new equipment cut readiness time drastically—from days to a very few hours. Moreover, the air unit employing the new system was better equipped for action than those not using it, a comparison showed.

These trials so impressed the Strategic Air Command and Tactical Air Command that they requested production of service test quantities of the containers for further trial to determine total Air Force requirements. At this writing, AF has received bids and is expected to award contracts shortly.

▶ **Handy Packages**—The box is the culmination of intensive, comprehensive studies by Becker & Becker Associates, New York industrial design engineers with offices in Dayton, Ohio, and London, England. Their assignment from USAF was "to increase mobility of operational units" through development of better packaging methods. B & B gave more than was asked. They cut out packaging and unpackaging by showing AF how to live out of its package.

B & B first sorted the equipment into two categories:

• **Heavy maintenance equipment** and spares needed for long-term operations, characteristic of a permanent installation.

• **Bare essentials** required to sustain an air unit efficiently for a minimum period, say, a month's time, at an advanced base, until slower supply lines are established.

After carefully weighing the multitude of factors involved and exploring many avenues to the problem of stores and supply, B & B developed a special container tailored to the demands of mobility. It is designed to be mass-produced at minimum cost and is built in five "key" sizes with convertible interiors, flexible enough to handle a wide variety of equipment, but standard enough to simplify storage and shipping, and economize on space. This achievement represented a complete overhauling of storage and supply concepts, B & B says.

The "unitized" design permits the various boxes to be made up into standard-sized packages for easy handling by fork-lift trucks and pallets.

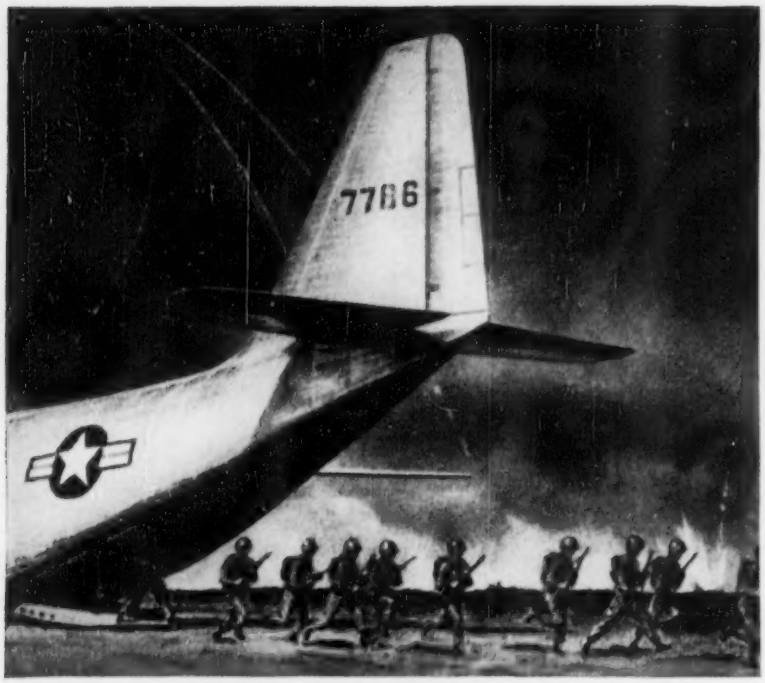
▶ **Time-Saving Features**—While on the ground, the containers serve as the warehouse shelves, the compartmented storage bins, the desks, libraries, filing cabinets and other facilities. In the air, they are the crates in which the supplies are shipped. Contents don't have to be disturbed for loading or unloading.

An air unit can figuratively close its suitcase and be ready to move in little more time than it takes to check out the aircraft and gas up. Warehouse, maintenance and housekeeping facilities quickly become portable and stack up into standard cargo lots, which can be made up of containers varying in size without lost space.

The plan is not only faster; it enables fewer planes to carry more, reduces the number of manifests and other paperwork, formalizes shipping procedures so that confusion is reduced to a minimum, cuts costs, and despite the standardization, provides greater flexibility in shipment and organization, B & B claims.

▶ **Lumber for Leaving**—Becker & Becker found in its survey that one of the first orders of business of some air units on being alerted was to put a call through to the local lumber yard. Others had wooden crates already made up in various sizes, since there was no standard to go by. They were difficult to pallet for full exploitation of cargo space, too heavy, and weren't utilized until and unless there was a move.

B & B's containers are used all the



FRONT LINE SHUTTLE *by Chase*

Chase Assault Transports keep pace with the furious tempo of modern warfare — shuttling troops and equipment forward to combat areas — back with casualties to rear area hospitals.

Expensive airfields are not needed. Chase C-123Bs land on *unprepared* fields — cow pastures or corn fields.

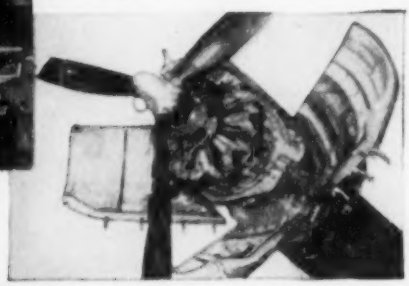
And these versatile transports need amazingly little room to get in — and get out — fast!

No other aircraft can match their performance in this vital shuttle operation.

CAMLOC SHEAR-TENSION LATCHES

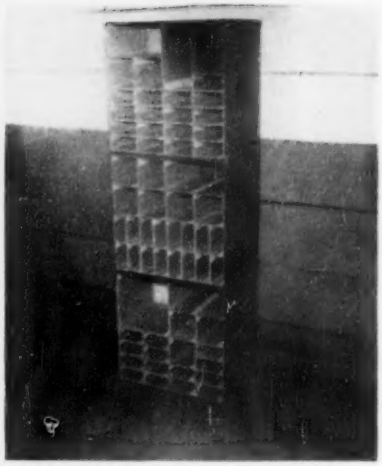
contribute to the performance of the C-123B by providing quick access for engine maintenance.

Camloc Quarter-Turn Fasteners are used on C-123B access doors.



CAMLOC FASTENER CORPORATION

Paramus, N. J. Los Angeles, Cal.



COLLAPSIBLE partitions allow flexible use of dual-purpose containers.

FOR SHIPPING, dividers stack in corner, make room for packing other items.

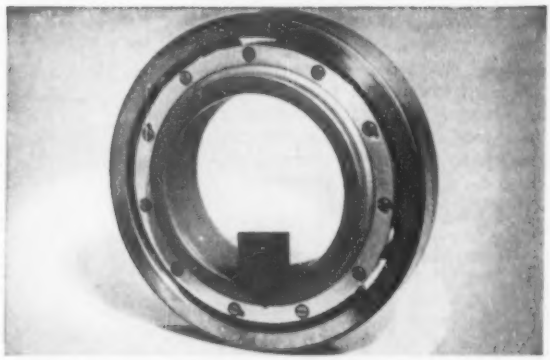
time. They are tough enough for shipment by rail or ship, light enough for air shipment. The boxes are made of Armorply, a laminated panel of a basswood core between aluminum skins, selected for its exceptionally high weight-strength ratio and production forming qualities. It handles like sheet metal, but has certain fabrication advantages. Armorply's collapsible core enables boxes to be assembled by crimping, instead of riveting, welding or other costlier methods.

The corners of the boxes are formed by modified L-shaped extrusions with "claw-like" terminations which bite deep and clamp securely without cutting into the edges of the metal-faced panels on being stamped. The wood core collapses, without fracturing either core or adhesive, and gives room for deep depressions to be formed in the metal-clad panel. The technique was developed by B & B, with the cooperation of U. S. Plywood Corp., producer of Armorply.

▶ **Easy to Handle**—Ridges at the top

'S' Monel...

an extra-hard casting alloy that resists galling and seizing at high temperatures



Takes the brunt of dry starts. Shown here fully assembled is the bearing cage for a jet engine turbine shaft. This bearing runs dry during the first moments of starting, causing a galling problem for the retaining ring. This retaining ring (arrow) between the inner and outer races is a centrifugal sand casting of "S" Monel, cast by Inco. "S" Monel not only offers a high degree of resistance to galling, but also retains its hardness at temperatures up to 1,000° F.

Whenever you're looking for hardness in a corrosion-resisting metal, it's a good idea to review the characteristics of "S"® Monel.

"S" Monel is one of the hardest and strongest of the non-ferrous alloys available in cast forms. What's more, it combines the inherent corrosion resistance of Monel with two particularly valuable features: 1) *extra* hardness at high temperatures, and 2) resistance to *galling and seizing*.

"S" Monel, in fact, maintains a hardness nearly as great as heat treated steel. Temperatures reaching as high as 1,000° F have but slight effect on its hardness.

There have been instances where "S" Monel has shown unusual resistance to seizing, despite poor lubrication – or no lubrication at all!

Another property of "S" Monel is that it is non-magnetic and stays that way at all temperatures down to —70° F.

It is this combination of exceptional properties – and the ability to retain them at high temperatures – that make "S" Monel especially useful for cast precision parts that can be counted on to –

- **take the brunt of high heat**
- **maintain accurate alignment or tight fit**
- **resist galling and seizing**
- **retain their resistance to corrosion, erosion and wear**

You'll find further information on "S" Monel in our bulletin, *Inco Standard Alloys for Special Problems*. Your copy is ready and waiting. Write for it now. And consult your distributor of Inco Nickel Alloys for the latest information on their availability from warehouse and mill. Remember, too—it always helps to anticipate your requirements well in advance.

The International Nickel Company, Inc., 67 Wall Street, New York 5, N. Y.

Mechanical Properties of "S" Monel*
(Age-hardened)

Yield Point	80-115,000 psi
Tensile Strength	120-145,000 psi
Elongation in 2-in.	4-1%
Hardness (Brinell)	300-375
Coefficient of Thermal Expansion (32°-212° F.) in./in./°F.	.0000068

Hardness of "S" Monel at Elevated Temperatures*
(As-cast condition)

Temperature, °F.	Brinell Hardness
Room	321
700	321
800	311
900	311
1000	321
1050	335
1100	293

Inco Nickel Alloys

MONEL® • "R"® MONEL • "K"® MONEL • "KR"® MONEL "S"® MONEL • INCONEL® • INCONEL "X"® INCONEL "W"® • INCOLOY® • NIMONIC® ALLOYS • NICKEL LOW CARBON NICKEL • DURANICKEL®

and recesses at the bottom of the containers allow them to be interlocked laterally and strapped vertically into compact, squared-off pallet loads, with all space used. The containers can be assembled in a wide variety of combinations with the five key sizes. A number of them together provides a neat package both for the fork lift and the aircraft.

It can be identified by only one manifest, instead of one for each container as is the case with odd lots.

Interiors of the containers are provided with partitions made of Tekwood, a laminate of low-cost wood core and kraft paper exterior, also produced by U. S. Plywood. The partitions can subdivide the container into 32 small compartments. They collapse for shipment to allow for maximum use of space. On the ground the partitions convert containers into storage and issue cabinets and bins in the advance base stockrooms.

During the exercises in England, AVIATION WEEK's correspondent saw many other examples of convertibility. Some containers opened up into four-drawer file cabinets, others into complete Tech Order libraries, while collapsible tables and desks opened out from others.

One container, the largest standard size (42 x 42 x 14 in.) disgorged a C. O's field desk with all papers in order.

B & B is exploring commercial uses of its mobile supply system, thinks it could be big cost cutter in air cargo and transport operations. It also is applicable to other fields of aviation, the firm believes.

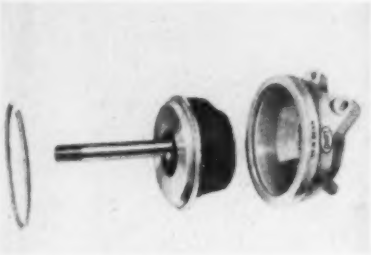
OFF THE LINE

Sferma, subsidiary of Societe Nationale de Constructions Aeronautiques du Sud-Ouest, has signed a contract with USAF at Wiesbaden, Germany, for overhaul of a number of C-47 twin-engine transports. The work is to be done at Sferma's Merignac factory, with engine overhaul performed by Air France. Cost of the program is expected to run to

A contract involving $53,000 for labor to overhaul 1,500 carburetors for R1830 engines has been received by Accessory Overhaul Industries, Inc., from an Air Force depot, the company reports. Address: 130-41 91st Ave., Richmond Hill, 18, L. I., N. Y.

Slick Airways will install complete Collins Radio Co. VHF radio equipment in its entire fleet of DC-6A and C-46 aircraft. Installation is scheduled to take place this summer.

NEW AVIATION PRODUCTS



Engine Shock Mount

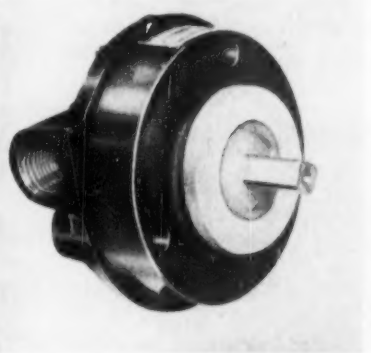
A new engine shock mount for R2800-C engines, said to be stronger but lighter in weight than any previous mount, has been announced by Lord Mfg. Co.

The Dynafocal mounting is interchangeable as to vibration characteristics and physical dimensions with types now in use on the Convair 240 and 340, Douglas DC-6 series, Martin 4-0-4, and military planes using the engine.

The weight saving realized with the new unit, the MR-36M, is as much as 16 lb. per engine on some installations. The mount has been approved by CAA, USAF and BuAer, Lord reports.

A core renewal service has been set up by the firm to enable maintenance personnel to replace from stock any fatigued Dynafocal mounting. Further details on this service can be obtained by writing to the company.

Lord Mfg. Co., Erie, Pa.



Tiny Scavenge Pump

A minimum of space and weight are used in a new compactly designed jet engine oil scavenge pump developed by Lear, Inc.'s Romec Pump Div.

The pump, measuring about 2 x 2 in., weighs 0.5 lb. and is a positive-displacement, rotary-vane type operating from an accessory drive of the jet engine. Romec claims this type of design provides a simplified, more powerful pumping element in a smaller envelope.

The Model RD-9820, smallest of the Romec series, has a rated speed of 3,800 rpm., outlet pressure of 60 psi., flow of ½ gpm. when pumping jet engine lube oil, Grade 1005. The pump provides a non-pulsating discharge and strong self-priming suction at speeds of 350 to 4,200 rpm., Romec says, and functions properly from −65 to 250F.

The steel working parts, assembled in an aluminum alloy body, consist mainly of two sliding blades in a cross-slotted rotor revolving in the bore of the pump liner. The "developed" bore of the liner controls sliding action of the blades and lengthens life of blades and the liner, the company says.

Romec Div. of Lear, Inc., Elyria, Ohio.

New Aircraft Hose

Aeroquip is producing Globe-Seal hose lines that can be connected directly to Ermeto and Ferulok flareless tube connectors.

Hose-fitting nipples mate the lines with Ermeto or Ferulok tube connectors without need for ferrules or inserts.

The fitting consists of two pieces: Aeroquip's standard hose socket and the new nipple. It can be assembled to the hose with ordinary hand tools.

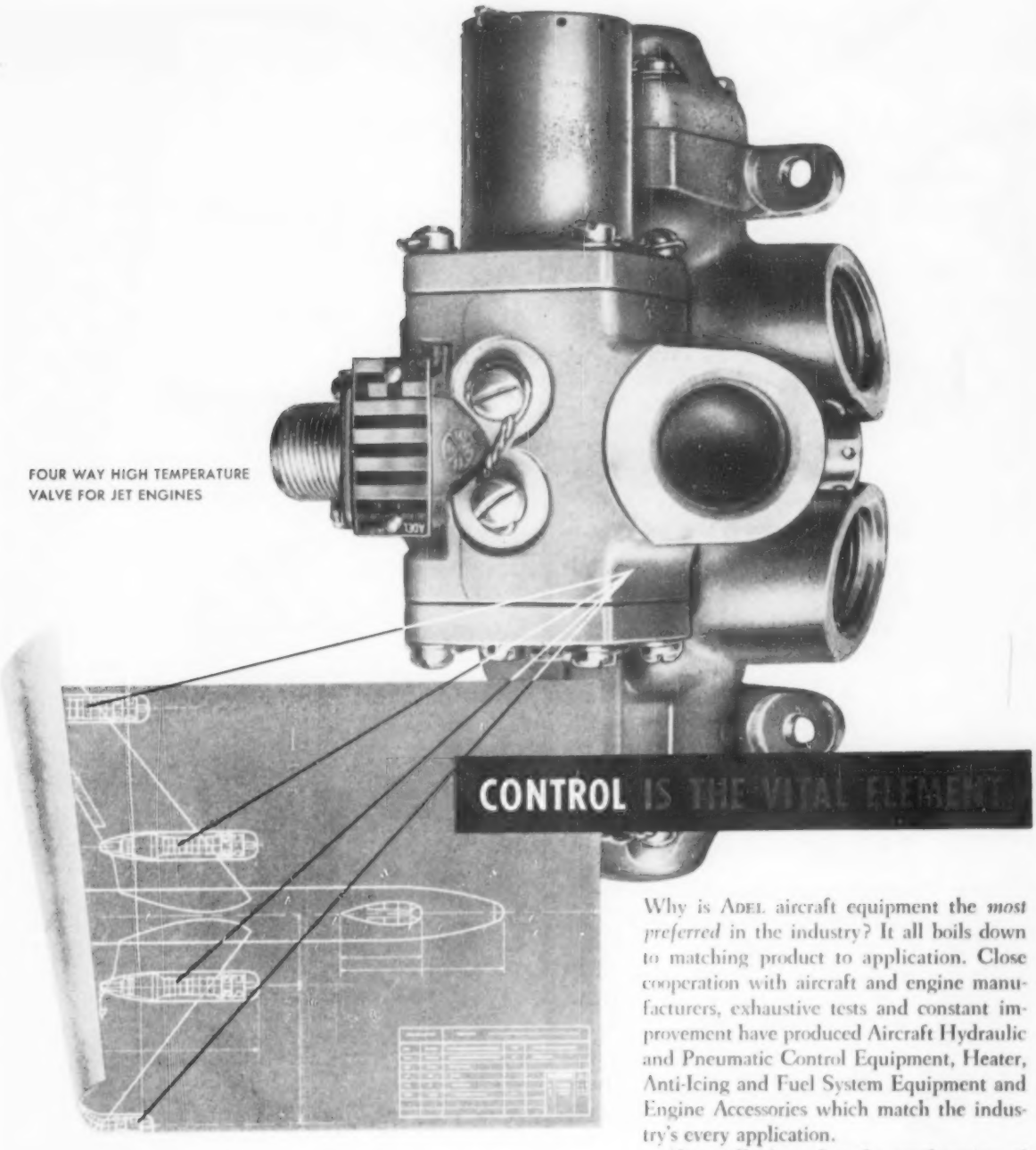
The hose is available in single- or double-wire braid.

Aeroquip Corp., 300 S. East Ave., Jackson, Mich.

Silicone for Molding

A new silicone rubber, designated SE-360, can be used to produce uniform parts from ordinary rubber molds and shows total linear shrinkage of only 3% after oven cure, compared with 6% for similar compounds, says maker, General Electric Co.

Deemed particularly applicable for capacitor bushings and for O-rings and packings in engines where gaskets and seals must remain effective under sustained pressure, SE-360 is said to have a compression set of only 8% after 22



FOUR WAY HIGH TEMPERATURE
VALVE FOR JET ENGINES

CONTROL IS THE VITAL ELEMENT

Why is ADEL aircraft equipment the *most preferred* in the industry? It all boils down to matching product to application. Close cooperation with aircraft and engine manufacturers, exhaustive tests and constant improvement have produced Aircraft Hydraulic and Pneumatic Control Equipment, Heater, Anti-Icing and Fuel System Equipment and Engine Accessories which match the industry's every application.

Above all, ADEL has the combination of specialized talent, experience and unequaled facilities essential for the successful solution of aircraft and engine control problems.

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CANADA: RAILWAY & POWER ENGINEERING CORPORATION, LIMITED

ADEL

ANNOUNCING
WIGGINS WIG-O-FLEX COUPLINGS
for connecting rigid tubes
PROVED SUPERIOR FOR FUEL, OIL, AIR
• 80% lighter • Installs locally
• Requires little more than hand tightening
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• Accommodates 4° tube flexure
• Requires only standard parts—"O" rings and tube beads
• Temperature range—65° F. to +250° F.
• Withstands more than 1,000 PSI burst pressure
SIZES
1", 1¼", 1½", 1¾", 2", 2½", 3", 3½", 4"
OTHER COUPLINGS ALSO AVAILABLE
for all liquids and gases
SELF-SEALING AND OPEN COUPLINGS
MANUAL AND AUTOMATIC OPERATION
HIGH PRESSURE — 3000 PSI
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Write for further information
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E. B. WIGGINS OIL TOOL COMPANY, INC.
3424 East Olympic Boulevard, Los Angeles 23, California

hours at 300F. Organic rubber sets nearly 100% under these conditions, GE claims, and general-purpose silicone rubber about 75%. Water absorption for SE-360 is stated to be 1% after immersion for one week at 70C.

Conventional press cycle of about 15 min. at 250F can be used, followed by a 24-hr. oven cure at 480F to obtain the maker's stated physical properties.

SE-360 is available currently as a 60 durometer compound. Used as a base stock it can be modified to yield 70 or 80 durometer compounds.

General Electric Co., Silicone Products Dept., Waterford, N. Y.

ALSO ON THE MARKET

New electronic standard cell for the aircraft industry operates on 28-v. d.c. input, provides output stable to ±0.15% when used intermittently and 0.1% when used continuously within the range of 0 to 100 v. and 0 to 30 milliamps. Small unit also has low a.c. ripple and can be used with recording oscillographs and as accurate power source for instruments measuring temperature, power, motion, strain, velocity and mass flow.—Hastings Instrument Co., Inc., Hampton, Va.

Airtab, convenient pocket-book for pilots is crammed with useful flight information, helps in planning trips and serves as a reminder of good flying practices.—Nimbus Inc., 2014 Holly Lane, Falls Church, Va.

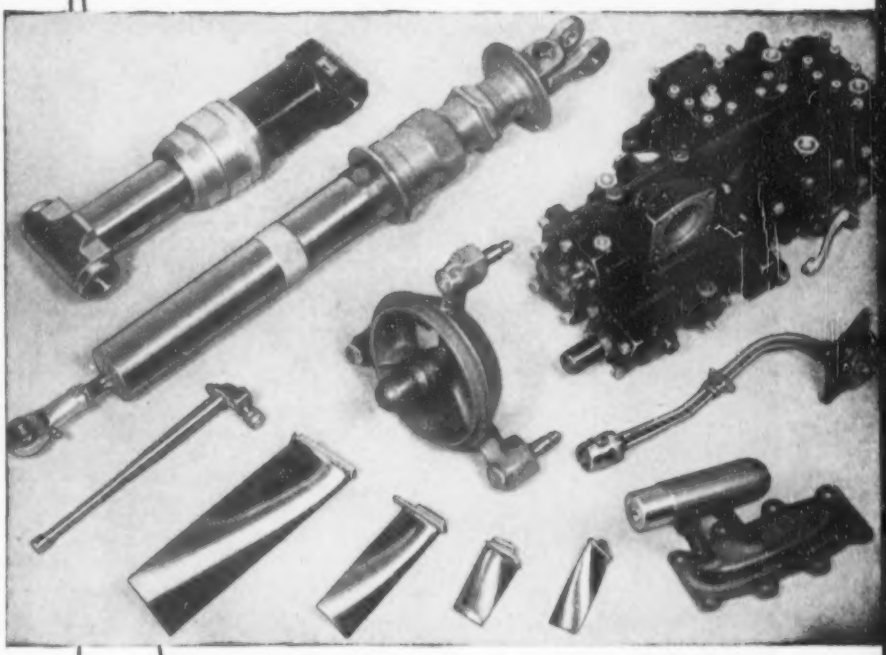
Electronic tachometer for measurement of speed, frequency or events per unit of time, uses cold cathode glow transfer tube to give clear, sharp reading. Emphasis has been placed on making unit reliable and service free.—Standard Electric Time Co., Springfield 2, Mass.

Speed-reducing pulley for light drill presses makes possible drilling up to 1⅛-in. in steel with only ½-hp. motor. Reducing sleeves also allow use on three motor shaft sizes: ½, ⅝ and ¾ in. Previous models could be used on only one shaft size.—Pull-Gear Co., 4118 E. 8 Mile Rd., Detroit 34, Mich.

Vibration and noise isolator Type 915 Barrymount is designed to provide efficient isolation at frequencies above approximately 20 cps., for equipment applying static loads of 15-200 lb. per unit isolator.—Barry Corp., 700 Pleasant St., Watertown 72, Mass.

Safety solvent designated Tecsolv 383, to replace carbon tetrachloride cleansers is said to be nonflammable, fast evaporating and low in toxicity.—Tect, Inc., Dumont, N. J.

Jet Parts and Assemblies
TO YOUR SPECIFICATIONS



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At Ex-Cell-O you'll find a rare combination of engineering skill, trained workers, and huge departments of up-to-the-minute precision machinery. There's a special Engineering Staff to plan the economical way to produce your part or assemblies including machining, heat treating, and unit assembly. Rigid inspection methods safeguard Ex-Cell-O's reputation for precision work.

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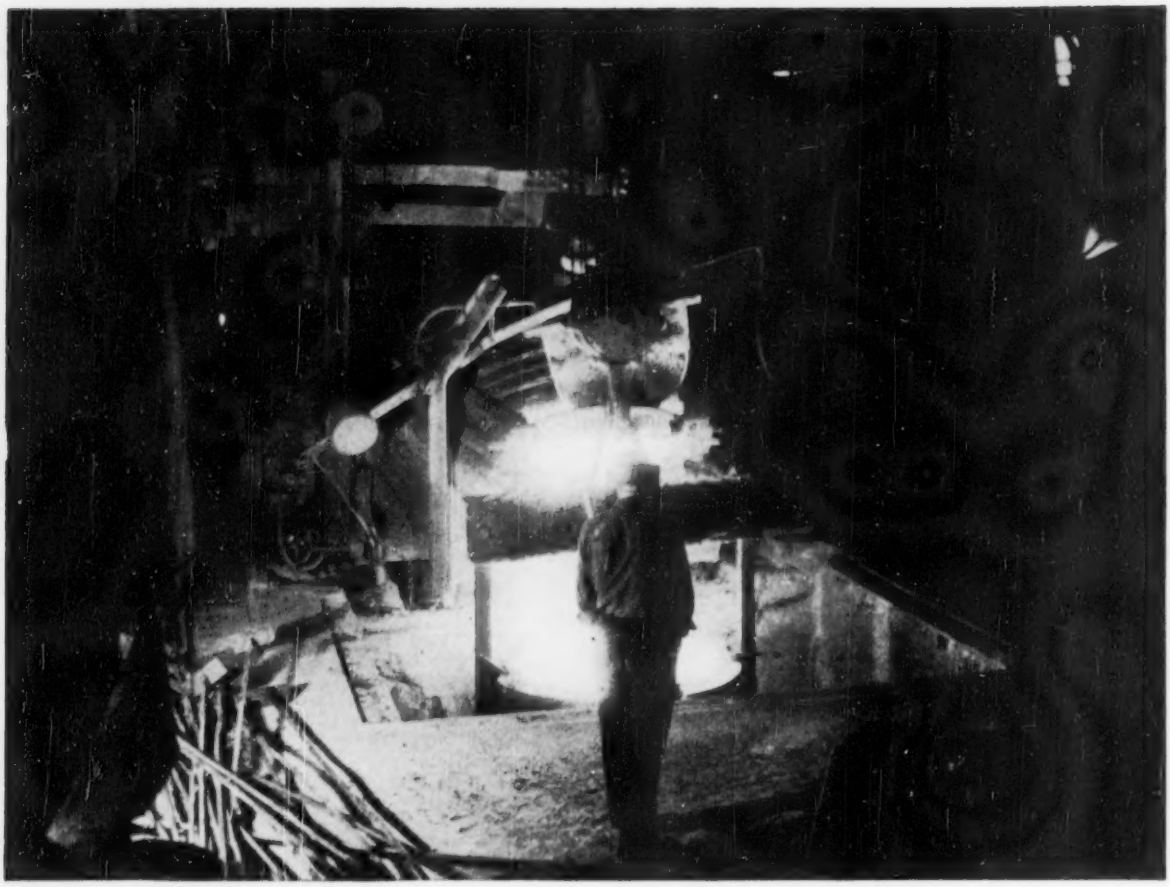

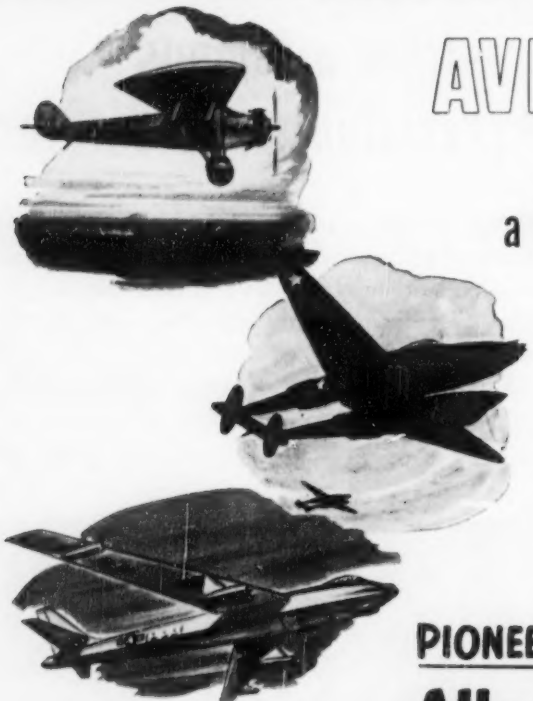

Warehouse stocks of Allegheny Stainless carried by all Ryerson plants

AVIATION

owes this veteran furnace a deep bow

From this very furnace (and its fellows) came the special heat-resistant steels for aircraft engine exhaust valves that first let men fly an ocean: Lindbergh, Chamberlain, Byrd. From it and its successors in various A-L mills came the high-temperature alloys that made possible the first aircraft superchargers . . . and later, the first ventures into jet and rocket-propelled flight. ● Whenever *you* have a problem of resisting heat, corrosion, wear, or great stress—or of satisfying special electrical requirements—remember to see us about it, won't you? ***Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.***

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LEADING PRODUCER HIGH-ALLOY STEELS

AVIATION SAFETY

Indian Government's Report on . . .

BOAC Comet Crash Near Calcutta

The official Indian government investigation of the loss of British Overseas Airways Corp.'s Comet jet transport near Calcutta May 2 suggests that pilot overcontrol while flying through a severe storm caused structural failure and resulted in the crash of the plane (AVIATION WEEK May 11, p. 17; June 22, p. 17). Thirty-six passengers and six crew members were killed.

The complete report, except for certain appendices, appears below.

ACCIDENT DETAILS

(a) Location: Jagalgori, a village about 24 miles, on a bearing 277° (T) from Dum Dum airport.

(b) Date and time of accident: 2nd May 1953, soon after 1105 hr. GMT (1635 hr. Indian Standard Time).

(c) Type of flying: Scheduled passenger flight, service No. 783/057.

(d) Object of flight: The aircraft was on a return flight from Singapore to London. It had taken off from Calcutta (Dum Dum) enroute to Delhi (Palam).

(e) Date and time of receipt of notification by investigator: On 2nd May 1953, at 1445 hr. GMT (2015 hr. IST) the Inspector of Accidents, Civil Aviation Department, New Delhi, was notified that the aircraft was overdue, and on 3rd May 1953 at 0400 hr. GMT (0930 hr. IST) he was further notified that the wreckage had been located.

(f) Date and time of arrival of Investigator at the scene: On 4th May 1953 at 0930 hr. GMT (1500 hr. IST) the Inspector of Accidents, New Delhi, accompanied by a Senior Inspector of Accidents from the Ministry of Civil Aviation, London, arrived at the scene of the accident.

SUMMARY OF ACCIDENT

On its scheduled return flight from Singapore to London the Comet aircraft G-ALYV of BOAC, carrying 37 passengers and crew consisting of six members, took off from Calcutta Airport, Dum Dum, on 2nd May 1953 at 1059 hr. GMT (1629 hr. IST) for Delhi (Palam).

The takeoff was normal. However, six minutes after its takeoff, radio communication contact with the aircraft was lost. It was last heard by Calcutta at 1105 hr. GMT calling Delhi (Palam). About that time some cultivators residing in the adjacent villages, Jagalgori, Chanashampur, Radhanagar and Mahishnan, at distances varying from 24 to 30 miles from Calcutta (Dum Dum), saw the aircraft coming down in a blaze of fire through severe thunderstorm and rain, and finally crashing into a nullah. There were no survivors.

WEATHER CONDITIONS

The BOAC representative was supplied with the following documents by the Meteorological Office for the use of the aircraft Commander:

(a) Flight forecast for the route Dum Dum to Palam together with a forecast of the expected takeoff conditions at Dum Dum including the expected temperatures, surface winds and pressure altitudes.

(b) Terminal forecasts for Palam and its alternates, Jodhpur and Allahabad, and return terminal forecasts for Dum Dum and its alternate, Gaya.

(c) A chart showing the sea level isobars at 0300 hr. GMT and the synoptic situation.

(d) A chart showing the streamlines of air movement at 30,000, 35,000 and 40,000 ft. above sea level.

The flight forecast was collected about 2½ to 3 hours before the commencement of the flight. The other documents were collected later at different times in instalments.

The flight forecast indicated the following expected weather:

- For the route from Dum Dum to 85° east:

Weather: Scattered thundershowers, moderate turbulence.

Low cloud: 4/8 cumulus; base 3,000 ft., tops 15,000 to 20,000 ft.; scattered cumulonimbus; base 1,500 ft., tops 35,000 ft.

Medium cloud: 2 to 4/8 altocumulus and altostratus; base 14,000 to 16,000 ft.

Surface visibility: ½ to 1 nautical mile in showers, otherwise 6 to 7 nautical miles.

- For the route from 85° East to Palam:

Weather: Local dust haze, otherwise fair.

Cloud: 2/8 cumulus; base 3,000 ft., tops 15,000 to 18,000 ft.

Surface visibility: 5 to 6 nautical miles.

The terminal forecast for Palam valid for the period 1000 hr. to 1500 hr. GMT (1530 hr. to 2030 hr. IST) indicated weather fair, surface wind variable 6 knots, visibility 3 nautical miles in haze, cloud 4/8 altocumulus, base 10,000 ft.

The return terminal forecast for Dum Dum valid for the period 1000 hr. to 1400 hr. GMT (1530 hr. to 1930 hr. IST) indicated cloudy weather with temporary thundershowers after 1100 hr. GMT, surface winds 180° 10 knots gusting to 15 knots and 340° 45 knots temporarily after 1100 hr. GMT, visibility 7 nautical miles generally, with 1½ nautical miles in thundershowers, clouds 4/8 cumulus, base 3,000 ft., 2/8 cumulonimbus, base 2,000 ft. generally with 4/8 cumulonimbus, base 1,000 ft. temporarily; 2/8 altocumulus at 13,000 ft. and 4/8 alto-stratus at 10,000 ft. had also been indicated in the return terminal forecast for Dum Dum.

At 0740 hr. GMT the following message was received by the Area Traffic Control from an aircraft VT-CQL:

"Storm developing 2410° N 89° E cumulonimbus 3,000 ft. moving southeast direction with very strong vertical updraft."

The Area Control Officer passed on the

where a leakproof joint is required . . . we recommend

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says BRANIFF International AIRWAYS

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above information to the Met. Office on tele-talk and also sent out the same as a CQ message for the benefit of all aircraft within the Calcutta flight information region. This CQ message was broadcast on air/ground frequencies between 0743 and 0747 hr. GMT.

The Comet on its way to Calcutta from Rangoon sent out the following signal at 0819 hr. GMT:

"Request forecast time of storm passing Calcutta."

In reply to the above, the Meteorological Office, Dum Dum, sent the following message to the Comet at 0853 hr. GMT:

"Reference your signal AAA Norwester expected Dum Dum area after 1100 hr. GMT."

The following special airfield warning for Dum Dum had been issued at 0945 hr. GMT:

"Thunderstorm accompanied with squalls from northwest speed reaching 50 knots likely Dum Dum airfield and neighborhood between 02 1200 hr. GMT and 02 1600 hr. GMT."

The Captain of the aircraft on receiving the airfield warning referred to above visited the Meteorological Office at about 1030 hr. GMT and he was personally briefed by and had a discussion with the Duty Forecasting Officer.

Subsequently an airfield warning issued by Palam and received at Dum Dum was passed on to the Area Traffic Control at 1120 hr. GMT as an addressed message for the Comet in flight but this message was not acknowledged by the Comet.

The actual weather conditions at Dum Dum at the time of takeoff were as follows:

Weather: Variable sky.

Surface wind: SSW 13 knots.

Visibility: 7 nautical miles.

Cloud: 2/8 cumulus, base 2,500 ft., $\frac{1}{8}$ cumulonimbus, base 3,000 ft.; total amount $\frac{3}{8}$.

The norwester affected Barrackpore first and Dum Dum later.

NAVIGATIONAL AIDS

The navigational aids carried on board the aircraft and those available on the ground were adequate for the flight undertaken. It is considered that the navigational aids did not have any bearing on the accident.

FIRE FIGHTING EQUIPMENT

The fire fighting equipment on board the aircraft was adequate. There is no evidence that it was operated either manually or automatically. This is considered to be due to the nature of the accident.

EXAMINATION OF THE WRECKAGE AND TECHNICAL INVESTIGATIONS

(a) Location of wreckage:

The main wreckage was located 24 miles from Calcutta Airport, Dum Dum, on the track from Dum Dum to Palam. It was lying in a water-logged nullah. The main wreckage consisted of the fuselage portion from the nose to cabin bulkhead No. 26 (half way down the passenger compartment), two stub wings up to rib No. 7 attached to the fuselage with the four engines in position. The rest of the components of the aircraft were found on a track 5½ miles in length on a heading about 334° (T). The

different components of the aircraft were found in the following order on the wreckage trail:

Port outer elevator and port top skin, starboard outer elevator together with starboard bottom mainplane skin, port tailplane with parts of rear cabin structure top fuselage skin, port inner elevator, starboard wing skin, sections of port fuselage side panel, starboard tailplane, fin and rudder, both outer wing panels, rear portion of the fuselage and the main wreckage in the mullah.

The terrain on which the wreckage was found is flat consisting of paddy fields.

(b) General Observations:

There were no scratches on the soft ground where the different components of the aircraft had fallen. It indicated that the pieces had fallen in almost a vertical direction with no forward velocity.

(c) Condition of Wreckage:

The main wreckage had been on fire. The main body of the aircraft had fallen into the nullah in an inverted position. There was severe damage on the structure of the aircraft due to impact and due to fire. Some of the separated fuselage panels had no evidence of fire damage. The rear fuselage unit had been damaged by fire and the portion aft of the pressure dome indicated severe damage due to impact. The port and starboard extension wing had severed from the main wing outboard of rib No. 7. Part of the port wing tip had melted due to fire damage. A deposit of smoke was found all along the leading edge of the flap and aileron, both on the port and on the starboard wings. The port aileron showed impact damage at three points on the trailing edge. The starboard wing had suffered severe impact damage at the wing tip. A small piece of the rear fuselage was found in the starboard wing. The leading edge of the starboard wing had suffered impact damage in the air between rib Nos. 7 and 14, and there were metal scratches all along the leading edge from the place of the impact right up to the wing tip.

(d) Technical Examination of the Wreckage:

Examination of the wreckage indicated that:

(i) The undercarriage and flaps were in the fully retracted position.

(ii) The throttle levers were broken and jammed. All the four throttles were in the "half-open" position.

(iii) High-pressure and low-pressure fuel cocks were "on."

(iv) The flying control system changeover levers were in their normal position.

(v) The elevator and aileron trim settings were about normal. The rudder trim setting could not be determined.

(vi) The cabin was being pressurized as disclosed by the spill valves.

(vii) The fire extinguishers had not been operated, nor was there any evidence of any emergency procedure having been taken.

(viii) Both the extension wings had failed at a station outboard of rib No. 7. On an examination of the wing panels it was noticed that the top panels had failed in tension while the bottom panels had failed in compression, indicating thereby a download failure of the wing. The top panels between ribs Nos. 7 and 12 indicated bending failure. The bottom panel consisting of

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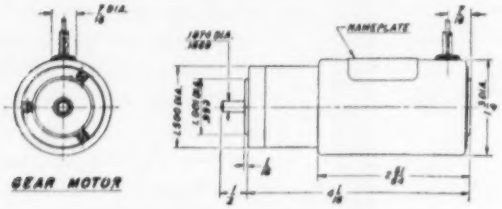

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several small pieces had sheared off at several points. The top and bottom panels on both the wings had severed from the main wing at rib No. 7. The aileron with its tab was in position on both the extension wings. The extension wing outboard of rib No. 12 with the aileron was found as one piece.

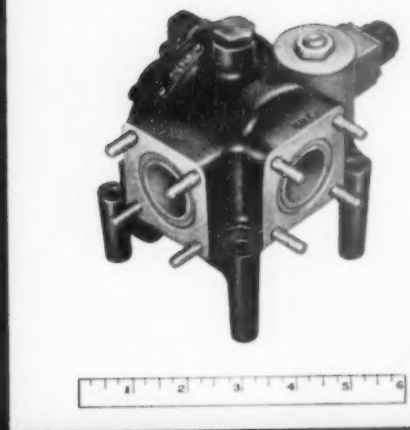
(ix) Tailplane: The port tailplane had suffered a heavy impact damage in the air right from the leading edge to the rear spar along its chord at a station close to No. 2 hinge bracket. The outboard tailplane had been completely severed from the inner unit at the above station due to impact. There was no structural damage on the tailplane panels outboard of No. 2 hinge bracket. The port inboard tailplane had broken off its attachment at the fuselage and at the front and rear spar points. The inboard piece had again broken into two pieces along the span somewhere in between the two spars. The No. 3 hinge bracket on the rear spar indicated an inboard side load. The No. 4 hinge bracket had sheared off at its center. The starboard tailplane had suffered impact damage in the air at the inboard leading edge. The two front and rear spars had failed near the root attachment.

(x) Elevators: The port elevator had been cut into two pieces along its chord close to the No. 2 hinge bracket. The inboard elevator piece indicated a skin collapse and had torn off its attachment to the operating torque tube. The elevator spar showed bending failure at a station in between No. 3 and No. 4 hinge brackets. It indicated a compression failure on the top flange and a tension failure at the bottom, that is, a down load failure. The mass balance appeared to have detached itself in a downward direction due the inertia load.

The starboard elevator spar had failed in bending significantly at the same point as on the port elevator. The compression failure at this point was severe and a collapse of the spar seemed to have sheared off the mass balance from its attachment to the elevator tip ribs. The No. 3 hinge brackets on the tailplane showed an outboard side load. The elevator had separated into two at a place in between the No. 2 and No. 3 hinge brackets. The inboard portion of the elevator had been torn off its attachment to the torque tube.

There was no damage on the tailplane around the point where the elevator spar had failed in bending. The bending failure of the elevator spar was localized at a particular station and there was no evidence of impact damage at this section. The elevator skin panel had suffered diagonal wrinkles due to tension field on a down load.

(xi) Fin and rudder: The fin had broken off its splice point at the insulation joint box. There was no structural damage on the fin panels. The top rudder hinge bracket had been twisted in a clockwise direction and the bearing had been sheared off its mounting on the bracket. The central rudder hinge bracket was intact and the hinge bolt had sheared off on the port side. The top rudder had broken at its jabroc attachment point to the lower rudder. The mass balance had detached from its attachment to the rudder tip. The lower fin and rudder had suffered extensive impact damage. The rudder operating torque tube had impact



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In operation, fuel at pump pressure enters a chamber above the valve diaphragm through a filtered inlet bleed passage. Connecting the chamber to the downstream side of the diaphragm is an outlet bleed passage which closes when a solenoid is de-energized. Thus fuel pressure in the chamber holds the valve member in closed position. Energizing the solenoid reverses the action — holds the valve open. DC power failure closes the valve—operation is fail-safe. If desired, an alternate configuration provides for *opening* the valve should power fail.

Integral legs permit mounting to the structure and allow adequate work area for attaching piping flanges.

SPECIFICATIONS: Type 141RL8 Fuel Shut-Off Valve

RATED FLOW: 12,000 lbs./hr. at 15 psi drop. Valve size may be scaled for larger or smaller flow rates, as required. **PRESSURE:** 600 psi maximum. **OPERATING PRESSURE:** 2.5 psi minimum. **OPERATING SPEED:** 1 second opening; 1 second closing. **TEMPERATURE:** Minus 65°F. to plus 300°F. **POWER SUPPLY:** 17-30 volts DC, 1 ampere maximum. **MATERIALS:** Housing: Aluminum alloy. Diaphragm and Seals: Teflon. Valve Members and all other parts: Stainless steel. **CONNECTOR:** AN3102A-10SL-4P. **PIPE CONNECTIONS:** AND10086-20 flange fittings. **OVERALL DIMENSIONS:** Height 4-21/32". Width 6-11/32". Length 5-13/32". **WEIGHT:** 3-1/2 lbs.

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marks at several places.

(xii) Fuselage: The fuselage had failed at frame No. 26 close to the attachment station of the fuselage to the center section wing. The fuselage panels indicated tension failure at the top and compression failure at the bottom. Some of the loose panels aft of bulkhead 26 that had detached themselves from the main body were not burnt. The rear fuselage had been affected by fire in the cabin portion.

COMMUNICATIONS

The communication equipment carried on board the aircraft as well as the ground facilities were adequate for the flight undertaken.

The aircraft contacted Dum Dum Aerodrome Control on radio-telephony frequency 118.1 mc. and obtained clearance to taxi and later to take off from runway 19 left. After takeoff the aircraft was cleared to change over to Dum Dum Approach Control frequency 119.7 mc. The aircraft reported to Approach: "Departing Dum Dum on course to Delhi."

The Approach Control gave clearance to climb under visual flight rules and to call when passing 7,500 ft. The aircraft was also informed that a Dakota aircraft from Delhi cruising at 7,500 ft. was expected to arrive at Dum Dum at 1115 hr. GMT. The Approach Control then passed QNH to the aircraft, but no acknowledgment of this was received from the aircraft. No further communication was received from the aircraft on this frequency despite several calls which were subsequently made by the Approach Control when they did not receive the expected call from the aircraft which it should have sent on passing 7,500 ft.

The Approach Control Officer contacted Area Control and was informed that they were in contact with the aircraft. The Approach Control Officer, therefore, did not attach any special significance to the lack of the expected communication from the aircraft to Approach Control.

The aircraft contacted Area Control at 1102 hr. GMT on wireless-telegraphy and reported: "Departed from Calcutta 1059 hr. Estimated time of arrival Palam 1320 hr. Climbing to 32,000 ft." It was on the strength of this message that Area Control had replied in the affirmative when Approach Control had inquired if they were in contact with the aircraft; and this was the last communication received by Area Control from the aircraft.

At 1105 hr. GMT the Communications' radio operator at Calcutta heard the aircraft calling Delhi. Delhi acknowledged and asked the aircraft to pass its message, but there was no response from the aircraft. The radio operator at Calcutta then called the aircraft informing it that Delhi was ready to receive the message. Despite repeated calls thereafter, there was no response from the aircraft. At about 1120 hr. and 1139 hr. GMT Area Control passed messages regarding Palam and Gaya weather to Communications for transmission to the aircraft. Communications attempted to pass these messages to the aircraft, but they were unable to make contact. The Communications were not worried as they thought that the aircraft might have temporarily suspended communication due to thunderstorm. However, this fact was not

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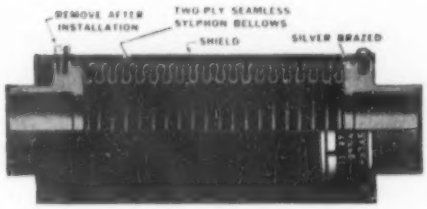

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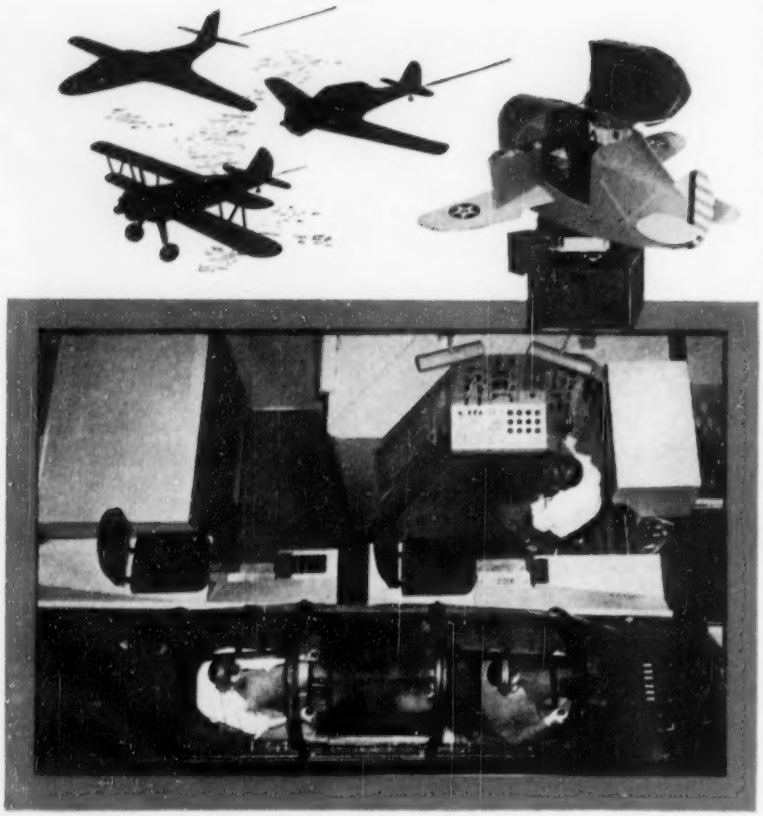

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known by the Area Control Officer, who presumed that normal communication with the aircraft was being maintained.

At 1158 hr. GMT Delhi inquired if Calcutta Traffic Control was in communication with the aircraft as a Dangermet report was held up at Palam. As a result of this, Calcutta Area Control checked with Communications and were informed that no message addressed to Calcutta had been received from the aircraft since the one at 1102 hr. GMT. It was then realized that all radio contact with the aircraft had already ceased.

SEARCH AND RESCUE ACTION

After it was known that communication with the aircraft had been lost, the Area Control Officer sent signals to aerodromes in the neighborhood as well as to other Area Controls and a general broadcast was also made on the air-ground frequencies. The aircraft was expected to land at Palam at 1320 hr. GMT and at 1325 hr. GMT the long-range R/T Operator was asked to find out from Palam if the aircraft had landed there. As soon as the information was received that the aircraft had not landed, the distress action was started. Messages were passed to Howrah and Sealdah Railway Controls. Police wireless was used to alert all police outposts. Military Headquarters was also informed as well as the I.A.F. at Barrackpore and the Chief Secretary, West Bengal, was also informed for passing information to all the districts. The Aerodrome Officer, Gaya, was particularly requested to alert the police and commence search in the areas between Gaya and Calcutta. Similar request was made to the Aerodrome Officer, Asansol.

All aircraft which were leaving Calcutta whether for Delhi or Karachi were asked to keep a lookout. No aircraft was sent out that evening for search, as it was considered that no useful purpose would be served at that time on account of weather conditions and darkness. Delhi was asked and it confirmed that search action was being taken from that side also.

One of the villagers who saw the crash communicated it to the village, Daroga, and to the Sub-Inspector of Police, Jangipara Police Station, who happened to be in a neighboring village for some investigation. He immediately went to the scene of the crash and found the two parts of the aircraft burning. He sent a messenger to the Police Station. It being a third-class Police Station, the only means of immediate communication was the Railway Telegraph Office. But the Station Master, who was asked to send a wire, found that the through wire-line from Jangipara to Howrah Maidan was defective on account of heavy storm and so he tried to send the message by train wire from station to station. He has given the details of the steps taken by him, and no message was in fact received at the Dum Dum Airport till next morning.

Prompt steps were taken by the Police to cordon off the area. None of the crew or passengers were alive. On the morning of 3rd May 1953 a BOAC York as well as two Indian Air Force aircraft commenced searching and information was received at Dum Dum Airport from the Police Headquarters, Lallbazar, Calcutta, that two aeroplanes seemed to have collided in the air and that the police officer had gone to the spot for

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investigation. As soon as this message was received, Area Control informed the search aircraft to proceed to the position reported by the police. A ground party which included the Airport Health Officer, the first-aid equipment and BOAC operations staff, proceeded to the BOAC City office where it was confirmed that the position of crash given by the police was correct and that the wreckage was that of the Comet. The land party then proceeded to the site of the accident.

Out of the 43 persons on board the aircraft only 40 bodies were recovered, and the remaining three must have been destroyed in the fire.

DISCUSSION OF THE EVIDENCE

The ill-fated jet aircraft Comet, G-ALYV, operated a scheduled service from London to Singapore. On its return flight from Singapore on 2nd May 1953, it landed at Dum Dum Airport at 0940 hr. GMT (1510 hr. IST).

At the airport the normal procedure was carried out as described by Mr. Jones, the Senior Station Officer, BOAC at Calcutta, who was in charge of the general supervision of all airport traffic handling arrangements as well as supervision of the operational side.

Documents examined show that the aircraft held a valid Certificate of Airworthiness and a valid Certificate of Maintenance. At the time of takeoff, its laden weight was below its regulated weight for departure from Calcutta (Dum Dum) and its CG position was within the safe limits. The Captain was an experienced pilot with adequate experience on Comet aircraft. He had also considerable flying experience of the route. Other members of the operating crew of the aircraft had the requisite qualifications and experience. They all held valid licenses.

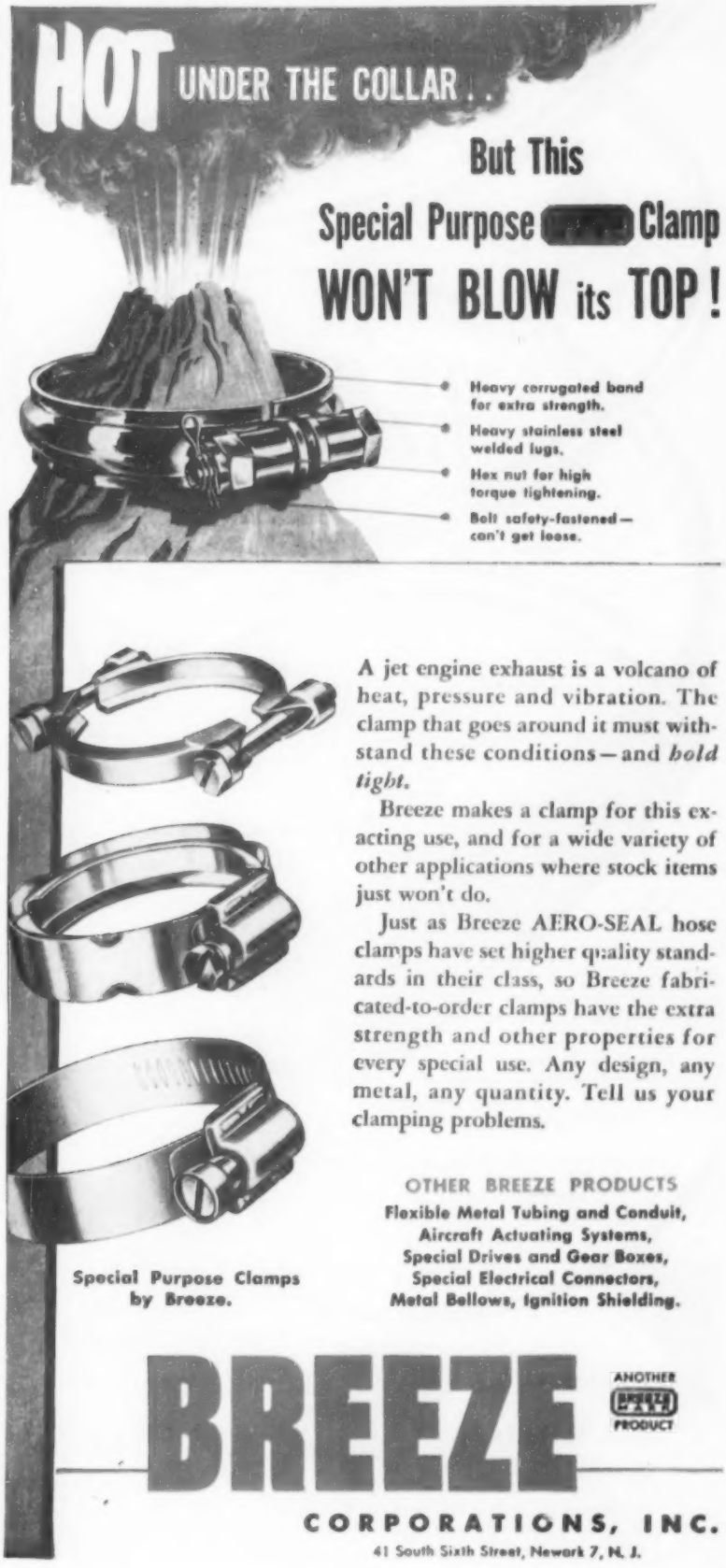
The Captain was duly briefed and given a clearance certificate which was duly signed by him. Before landing, he was informed of the expected storm at the airport after 1100 hr. GMT (1630 hr. IST). After landing, he was informed of the weather forecast that the storm was expected between 1200 and 1600 hr. GMT (1730 and 2130 hr. IST).

A warning of the expected storm was also issued by the Area Control Officer, which was received by Mr. Wheeler, the Station Officer of the BOAC and passed on to the Captain of the Comet. It was to the effect that a thunderstorm accompanied by squalls from the northwest with speed reaching 50 knots was expected over Dum Dum and neighborhood between 1200 hr. and 1600 hr. GMT (1730 hr. and 2130 hr. IST). Both of them then went to the meteorological office where the Captain had a discussion with the Officer on duty, Shri Chakraverti. It seems that the Captain was more anxious to ascertain the weather at the terminal (the Palam Airport) where he was to land than about the en-route weather.

The weather minimum for Comets at Calcutta has been described in a BOAC Manual as follows:

"Subject to the ILS and the non-directional beacon being serviceable, the takeoff conditions for Dum Dum on runway 19 (which was the runway that the aircraft had used) is cloud base 300 feet and visibility 1000 yards."

The actual conditions at Dum Dum at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the time of takeoff were well above this minima and as regards the en-route weather minima, no specific instructions are issued, and it is left to the discretion of the Captain of the aircraft. The Captain of the Comet, following his discussion with the Meteorological Officer, decided to take off, and taking off at 1059 hr. GMT (1629 hr. IST), he encountered the squall within six minutes thereafter. About half an hour later Mr. Vlotman flew from Dum Dum Airport to Karachi in a KLM Constellation and though he encountered the storm at a distance of 12 or 15 miles, he safely passed through it at an altitude of 4,500 feet. Of course, he was going in a slightly different direction, but he had been briefed by the meteorological office at Dum Dum that there was a system of cumulo nimbus clouds not far from Calcutta to the west.

Unfortunately, the storm which the Comet encountered, as the eye-witnesses from the neighboring villages state, was unusually severe. The Captain was not only well-qualified, but had considerable experience of weather conditions on this route. He was, therefore, fully competent to judge the weather forecast en route and the warning given, and make up his mind whether to take off or not. It would not be right to accuse him of any imprudence in taking off in spite of the warning.

It would not be out of place to point out here that the Director-General of Civil Aviation has issued a Notice to Airmen No. 33 of 1952, dated Oct. 31, 1952, requiring that at aerodromes where the service or flight originates and at intermediate halts, the Pilot-in-Command or the Flight Operations Officer (Flight Dispatcher) duly licensed by the State of Registry, should report in person to the Air Traffic Control Officer for briefing before commencement of the flight. No flight dispatcher having been thus licensed by the State of Registry, it is incumbent on the Pilot-in-Command to report in person to the Air Traffic Control Officer, who should insist upon such attendance before signing the clearance certificate. But as stated by Mr. Jones, the procedure followed is for the Flight Operations Officer to go to all the briefing departments at the commencement of his tour of duty and make a record of the briefings. In the present instance, the Operations Assistant Sundararaman collected the briefing and obtained the clearance certificate from the Area Control Officer, which he handed over to the Captain. The Pilot-in-Command usually does not report personally to the Air Traffic Control Officer.

This procedure is a clear violation of the notice issued by the Director-General of Civil Aviation. In the present case, however, this has no direct bearing on the investigation as there is no doubt that the Captain of the Comet was in full possession of the briefings and all the information relevant to his flight.

What exactly happened when the Comet encountered the storm and what the crew did, is difficult to say. According to one eye-witness, there was a thud of something falling behind a haystack and he saw that it was something like shining metal. Evidently, it was a part of the fuselage of the Comet. He then saw a blaze of fire in the sky. Another eye-witness saw a flash of light and looking up saw that a plane was on

fire. He heard a bang in the sky and saw the plane split into two, one piece falling into a nullah burning violently, and the other falling to the ground and burning at some distance. He heard two more loud reports after a minute or two. In his opinion, the storm on that day was unusually violent.

All this must have taken place at about or immediately after 1105 hr. GMT (1635 hr. IST). Till then the Comet was in radio communication and the contact ceased thereafter. All subsequent attempts to contact it proved fruitless.

We have no evidence before us to indicate sabotage, or a stroke of lightning or faulty workmanship or defective material. There being thus no direct evidence as to the cause of the failure of the Comet to get safely through the storm, we have to infer it from the state of the wreckage, which was distributed over a large area.

There is no doubt that, as an expert witness Mr. Lett has stated, the aircraft suffered a complete structural failure in the air and thereafter the aircraft was on fire in the air. One of the assessors has, after a careful inspection of the wreckage, arrived at a deduction which is embodied in his note in Appendix VII. The reasons given by him for the conclusion are quite plausible. But we think that a further prolonged and technical study of the wreckage is necessary to verify his deduction and determine the sequence of failures. This, in Mr. Lett's opinion, may take about nine to twelve months, and it is hoped that this will be done by the State of Registry of the aircraft as soon as possible.

FINDINGS

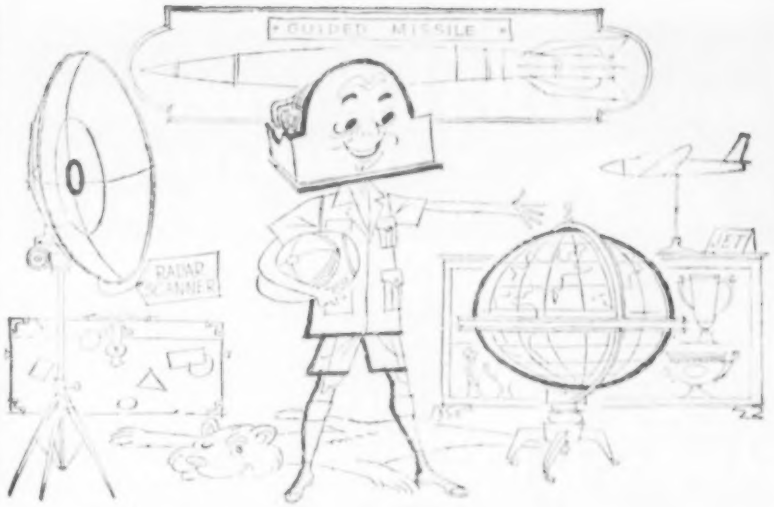
The Court finds that:

- The aircraft held a valid Certificate of Airworthiness. It had been maintained in accordance with the approved maintenance schedules and held a valid Certificate of Maintenance.
- The crew held valid licenses and were competent to undertake the flight. The Captain had considerable flying experience on the route.
- The gross weight did not exceed the regulated weight and the position of the center of gravity was within the safe limits laid down in the load and trim sheet.
- Before departure the Captain was in possession of all the relevant meteorological and air traffic control information required for the flight. This included the warning of a thunder-squall.
- The aircraft encountered a norwester squall with thunderstorm shortly after take-off when climbing to its cruising altitude, and suffered structural failure in the air which caused fire.
- An examination of the wreckage on the site did not reveal any sign of sabotage, lightning damage, faulty workmanship, defective material or power plant failure.

PROBABLE CAUSE OF THE ACCIDENT

The accident was caused by structural failure of the airframe during flight through a thundersquall. In the opinion of the Court the structural failure was due to overstressing which resulted from either:

- Severe gusts encountered in the thundersquall, or



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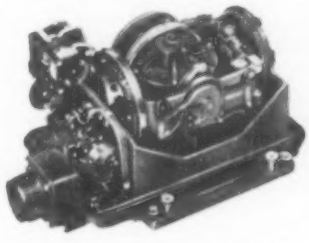

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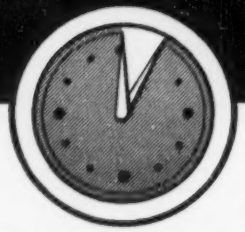

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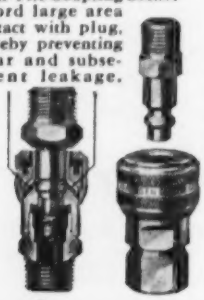

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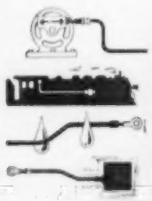

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• Overcontrolling or loss of control by the pilot when flying through the thunderstorm.

RECOMMENDATIONS

The Court recommends:

• That the wreckage should be transported as soon as possible to the State of Registry and its detailed technical examination be undertaken with a view to determine the primary failure and to consider if any modification in the structure of the Comet aircraft is necessary.

• That consideration should be given to the desirability of modifying the flying control system of the Comet aircraft in order to give the pilot a positive "feel" of airloads exerted on the control surfaces.

/s/ N. S. LOKUR, Court
/s/ K. M. RAHA, Assessor.
/s/ N. SRINIVASAN, Assessor.
/s/ T. R. NELSON, Assessor.

Calcutta Airport,
Dum Dum.
26th May 1953.

APPENDIX VII

PROBABLE CAUSE OF STRUCTURAL FAILURE

(As deduced by Shri W. Srinivasan, Assessor)

A technical examination of the wreckage has supplied several significant features that indicate a structural failure during flight in stormy weather conditions. Fire is a subsequent occurrence that has spread from the wing tanks on to the main body of the airplane. A study of the different components and their nature of failure strongly suggests primary failure of the elevator spar in bending due to a heavy down-load imposed on a "pull-up" by the pilot when the aircraft encountered a sudden down-gust during its flight across a "norwester squall."

Weather Data

The Comet during its climb about 6 minutes after takeoff met stormy weather conditions. The "norwestersquall," according to meteorological experts, consists of a column of rising hot air currents in the "formative" stage covering an area varying between 30 and 40 square miles. The upgusts that are created increase in speed as they rise in altitude towards the cloud base. The squall may even consist of many vertical cells at different stages of formation. Mixing with the cloud and the surrounding air, the "mature" stage starts with a downpour of rain and consequent down-gusts of velocities varying between 15 and 50 miles per hour.

Definite data on the gust velocities occurring in these norwester squalls, so characteristic of the Calcutta region during May and April, cannot easily be obtained even with the modern equipment and facilities. However, up and down gusts varying in intensity from 15 to 50 miles per hour at different altitudes are possible during the stormy weather conditions. On evidence by experienced pilots, it has been noted that the best way to fly through a storm or squall is to cut across at 90° with manual controls (i.e. without autopilot). While flying through a thunder-squall, the Captain takes over the controls and tries to maintain the attitude of the aircraft the same. The co-

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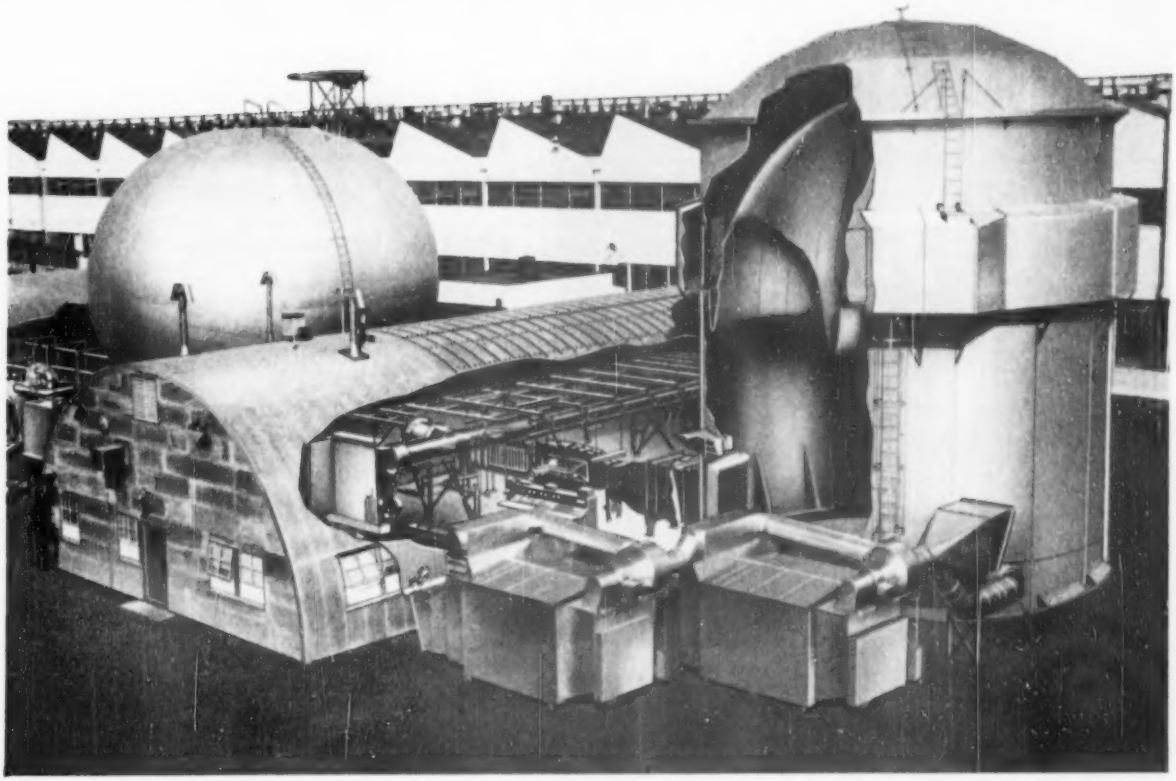

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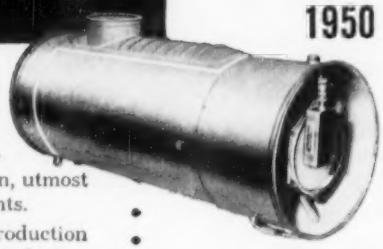

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pilot keeps a watch on the airspeed indicator and controls the throttle with a view not to exceed the specified limit maneuvering speed.

Primary Failure

A close examination of the spar in either elevator shows a bending failure at a station in between the No. 2 and No. 3 outboard hinges. It is a down-load bending with compression at the top flange and tension at the bottom. It is significant that this failure is of a localized nature with no damage over the surrounding area either in the tailplane or elevator skin, in spite of the subsequent impact damage observed on other portions of the structure. This elevator down-load failure may have been due to a "pull-up." The down-load on the tail-unit seems to have caused a fuselage failure in bending at bulkhead No. 26. The top panels have failed in tension and the bottom panel in compression.

During flight in a down-gust, the aircraft not only loses altitude, but it takes a nose-down attitude. The airspeed increases. The pilot immediately reacts to keep the attitude of the aircraft the same by a "pull-up" and the co-pilot throttles back the engines for reducing the speed to keep it within the specified limit. The wreckage reveals that all the four throttle controls were found in the "half-open" position. The aircraft has responded to the corrective action taken, but a sudden elevator failure must have imposed a heavy down-load on the wings with the resulting wing failure at about Rib. No. 7.

It is also significant that the extension wings have failed at about the same station points on both sides. The extension wing panels have tension failure at the top and compression failure at the bottom. The above structural failure must have been so rapid that the crew and the passengers have been subjected to a high positive G first during the "pull-up" and perhaps a higher negative G on elevator failure. The inner panels of the outer wing between Ribs 7 and 12 have flapped up and down and detached themselves at Rib 7 by bending failure.

Probable Successive Failures

The detached wings lagging behind the main body of the diving aircraft may have impacted the tailplane on the port side and the fuselage on the starboard side. It is difficult at this stage to determine exactly the flight path of the two extension wings after separation in relation to the main body of the diving aircraft and say exactly which portion of the wing hit the tail-end of the fuselage and tailplane. The starboard extension wing has suffered heavy impact on its leading edge. There are indications to show that it has been hanging on to same metal panels chafing its leading edge right along the spar. The starboard tailplane has impact damage on inboard leading edge.

The rudder appears to have been torn off its support to the fin by an impact. The fin has broken at the insulation box. The fin and rudder do not have any evidence of structural failure due to airloads. It is highly improbable for the surfaces to have sustanied the airloads that could damage the hinge bolts and brackets as seen on the wreckage. The direction of the broken hinge bracket piece indicates that the impact load has come from the operating side. The way the inboard elevators have sheared off their mounting on the torque tube also suggests their damage due to sustained impact loads from the control side.

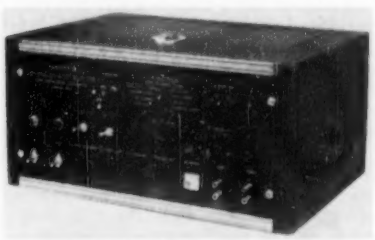
An examination of the tail portion of the fuselage reveals that it has suffered some impact in air from one of the wings. The starboard extension wing leading edge may have struck the fuselage tail and imposed the heavy loads on the elevator and rudder control torque tubes mounted at bulkhead 52. These loads could have sheared off the rudder from its support, broken the fin also at the insulation box and broken the inboard elevators off its hinge support. A heavy impact on the torque tubes will naturally shear the control surfaces off their hinge supports. The port wing aileron trailing edge has impact marks at three places. It is difficult at this stage of the investigation to match any impact damage with that found on the tail-unit or any other component. But there are indications that the port wing has caused the damage on the port tailplane.

Fuel from the outboard tank appears to have run along the wing span through the nose of the aileron right from Rib 7 to the wing tip. The detached extension wings with kerosene smeared all over, during their flight path across the jet blast have picked up fire. That explains the deposit of smoke at several places along the wing's span.

The broken wings seem to have deposited smoke on the fuselage tail during its impact. This explains the reason why the fuselage tail has deposit of smoke while the just forward fuselage panels have not. The fuselage initial failure has been at bulkhead 26. The fuselage panels (between bulkhead 24 and pressure dome) have opened out in flight and broken off its attachment at bulkhead 26. The aircraft with a stub wing and no tail-unit may have got into some type of auto-rotation during its fall and settled itself into the nullah in the inverted position with the nose pointing south-east.

Remarks

On an examination of the wreckage and the major components with the facilities available at the wreckage spot, it has been suggested that the primary failure may have



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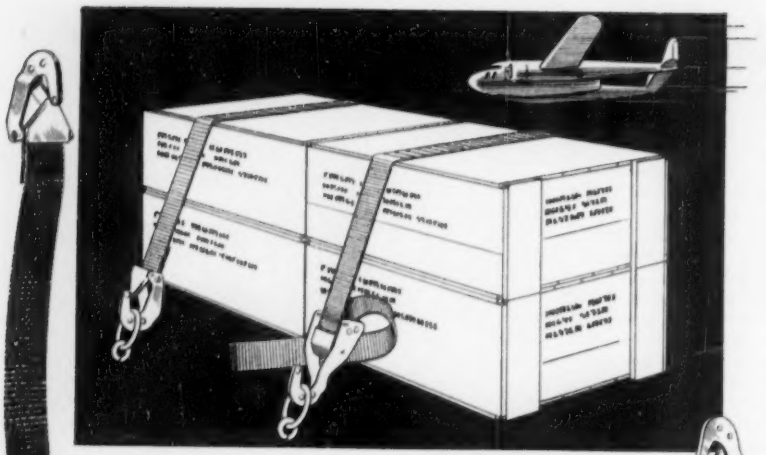

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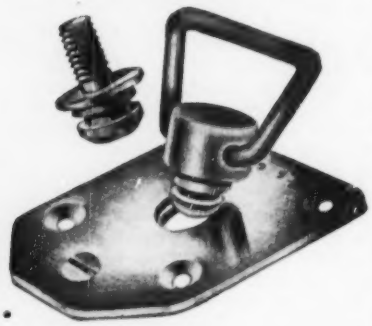

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been on the elevator. The metal elevator does not have a closed nose box to take the torsion loads. The triangular metal box aft of the spar forms in fact the only torsion resisting member on the elevator. The torsion will be resisted by the skin panels in tension field. There are indications on the starboard elevator to show that it has suffered a down-load and permanent diagonal wrinkles. The spar in between No. 3 and No. 4 hinges appears to have given way in bending. The spar along with the normal air-load bending will have secondary bending induced due to the tension field components on the skin panels.

The elevators may have been stressed to the balancing and maneuvering loads encountered during flight in gust conditions as per design requirements. A static test may also have been carried out to test the skin panels in tension field on a down or up load torsion in view of the absence of a closed nose section. In the absence of design details, it has not been possible to be definite on the comparative structural strength of the major components.

Normally, it may be possible to plot the trajectories of the falling bodies and predict with a certain amount of accuracy the primary failure of the aircraft. Since the aircraft disintegrated into several pieces up in the air with several successive failures and collision loads between parts and due to the fact that definite data on the wing velocities at the time of wreckage are not possible, no attempt was made to draw the trajectories and predict the primary failure.

It is understood during the investigation that the wing was subjected to a static test by the manufacturing firm during the development stage of the aircraft. On one test piece static and fatigue tests were conducted alternately. The wing failed in fatigue test and after modifications was subjected to a static test. The wing failed again at 90% of the ultimate load. The failure was attributed to the fatigue test conducted before. Modifications were carried out again and, with a re-test, it was found satisfactory for the ultimate load on theoretical considerations. The fatigue failure during static test occurred at Rib No. 7 where the cross-section changes from two heavy spars to an outboard shell construction.

In this accident, again the wings have significantly failed at Rib. 7. Whatever the load may be the failure at Rib 7 may indicate the lack of proper diffusion of the wing loads on to the two spars at Rib 7. In the absence of design data no definite comments can be made on the wing failure, but a further investigation on the above subject of load transfer at Rib 7 will help.

It is extremely difficult during this short period of investigation with limited facilities and data to substantiate the primary failure with all details, but there are strong indications on the wreckage to suggest the primary failure of the elevator during a "pull-up." The Comet has got an elevator control system operated with booster power with no feedback arrangement for pilot feel. It is quite probable that the pilot, who is accustomed to a sort of "feel" on the controls during maneuvers had overcontrolled the aircraft beyond the limit that would impose the design loads on the aircraft. In this respect any modification to incorporate a control "feedback" in the elevator system will be a definite improvement.

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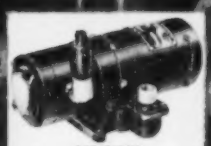
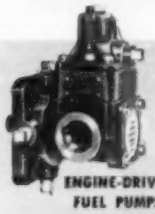
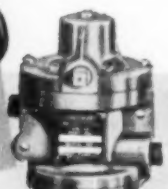


AIRCRAFT PRESSURIZING PUMPS



ENGINE-DRIVEN FUEL PUMPS

HYDRAULIC AND OIL TRANSFER PUMPS



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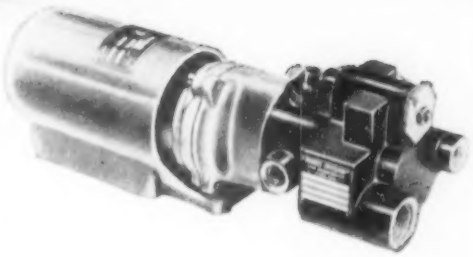

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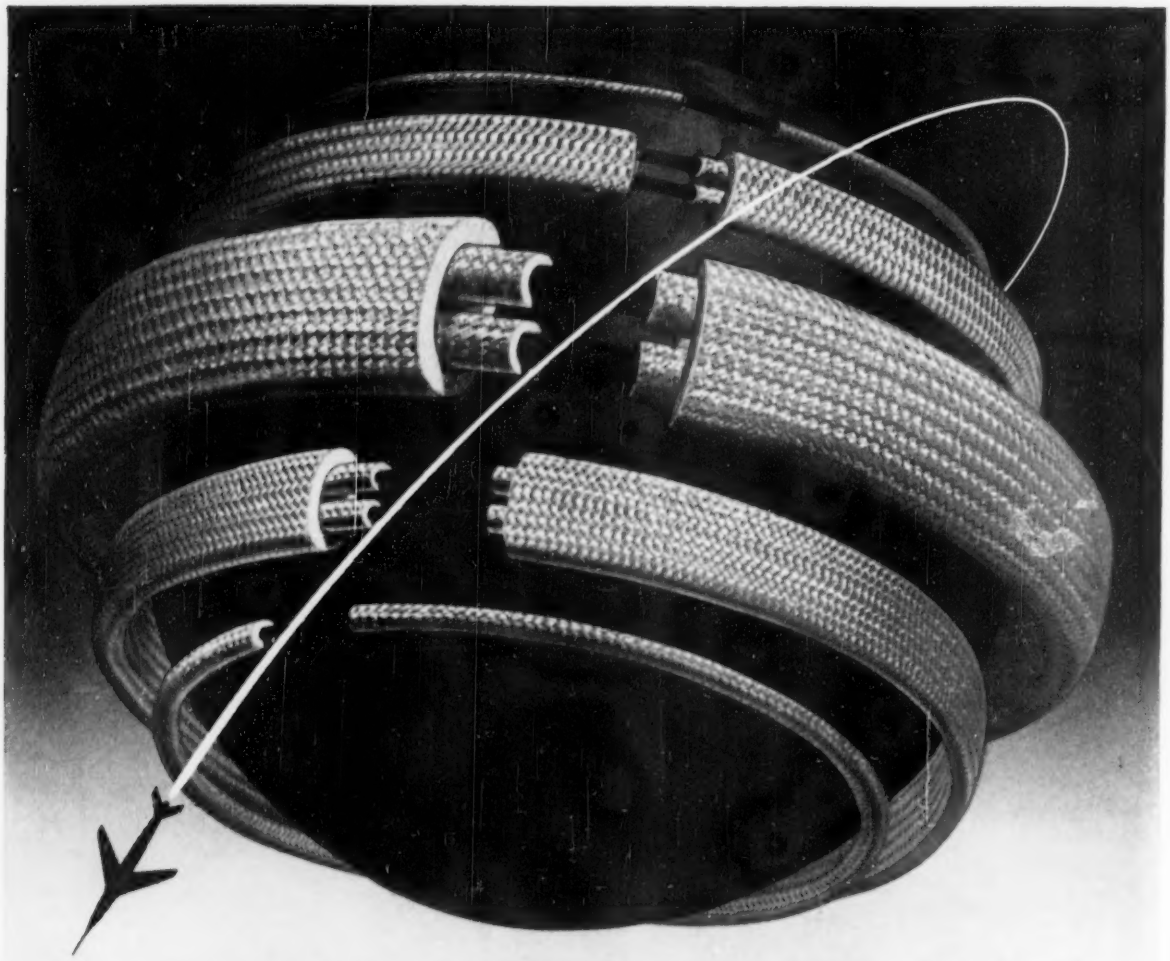

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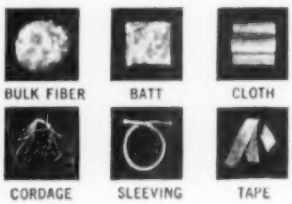

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Route Case Outlook: CAB Decision in '54

- **Hearings delayed to fall by application fight.**
- **Small airlines want right to compete with Big 4.**

By Lee Moore

Delays in Civil Aeronautics Board hearings of the three transcontinental route cases originally scheduled for this summer will drag the decisions well into 1954.

Latest barrier is a legal fight over whether to allow the route application of a nonsked (North American Airlines) to be heard with those of the trunklines, CAB chief examiner Francis Brown says.

▶ **Hopes and Fears**—When that issue is settled, the Board faces more battles over various trunkline applications in the complex Southwest service case.

The Southwest plus the New York-Chicago and Denver service cases affect every trunk airline in the nation. Each major air carrier hopes for competitive extensions of its own routes but fears encroachment by others. The hopes outweigh the fears, however, because the airlines figure they'll gain more business on new routes than other lines will take away from them on their old ones.

The Big Four—American, Eastern, Trans World and United Air Lines—are fighting for each other's routes, and smaller lines are after them, too.

▶ **Aggressors**—The medium-sized carriers, like Braniff International Airways and Capital Airlines, believe they have everything to gain and little to lose. They have relatively small participation in the best routes of the country and, where they do participate in the major markets, the airlines already compete with the Big Four. If CAB allows competition on more of the major routes, the smaller carriers ask first call on them.

The smaller airlines will cite statistics similar to those in the accompanying table, showing their present competitive disadvantage with the Big Four.

But before that step, they must make sure CAB consolidates their applications in the route cases so that they may be heard. Board decisions on which applications apply to the case are the important issue now.

▶ **Route Restrictions**—Here is an example of the type of decision CAB must make before deciding which applications to consolidate in the Southwest service case: Capital asks a short route extension to Dallas/Ft. Worth competitive with American and another to Houston in competition with Eastern. But Capital says it still could not give effective service and competition unless the restrictions existing along the way are lifted.

Capital competes with the Big Four for almost all of its business but is at a severe disadvantage because route restrictions make its service circuitous between various cities. For instance, the airline started the first domestic New York-Chicago trunkline aircoach service in 1948, but when the Big Four followed, Capital was forced out because they had CAB rights to nonstop service, while it had to stop twice en route.

▶ **Two Planes, One Job**—From New York, Capital's major southern cities—Atlanta, Birmingham, Mobile and New Orleans, lie on a line, both physically and from traffic demand standpoint. But old CAB restrictions require the carrier to run two planes half empty, one to Atlanta and another to the other towns, while competitor Eastern has scheduling freedom.

Other restrictions prevent Capital from serving those cities from its Washington, Baltimore and Philadelphia terminals on the same flight as New York.

In effect, the airline must fly two planes to do the job of one on many of its city combinations. Because this is uneconomic, Capital actually stays out of some of its own obvious markets: New York-Atlanta and New York-Chicago.

The smaller cities tied in with

Effective Route Competitions* In Top 100 Air Markets**

	No. of top 100 city pairs served	Share of all monopoly traffic in the 100 mkts.	Own monopoly as % of co. total in 100 mkts.
American	36	22	18
Eastern	23	38	42
TWA	29	21	26
United	35	11	11
Braniff	4	2	36
Delta-C&S	4	3	14
Northwest	10	4	19
Capital	11	0	0
National	6	0	0
Western	6	0	0
Northeast	1	0	0
Colonial	1	0	0

* *Effective competition defined as any single-carrier competitive routing hauling 10% (or more) of the volume of the dominant carrier between the two cities (excludes connecting services).*

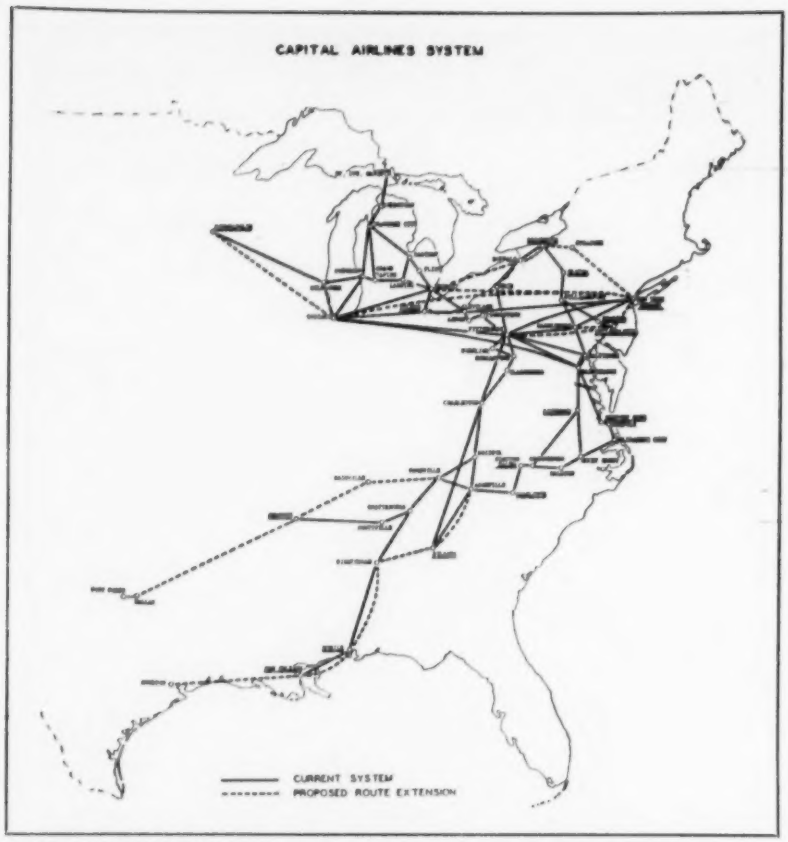
** *Top 100 U. S. markets are the 100 pairs of cities with the highest passenger mile volume moving between them in March, 1952.*

SOURCE: Official airline traffic survey, CAB, March 1952, as analyzed by a major airline.

ICAO Renames Warner

Dr. Edward Pearson Warner last week was unanimously re-elected council president of the International Civil Aviation Organization by delegates to the seventh annual assembly at Brighton, England.

The U. S. aeronautical engineer has headed ICAO's council since the organization's inception eight years ago.



CAPITAL WANTS ROUTES giving it better break against Big Four competition.

those bigger ones likewise are restricted.

▶ **Essential Issue**—These southern route problems of Capital are affected by the new Southwest route case in which the essential issue is competition from the northeastern part of the nation. Through various alternative routes—including Cap's—to the Oklahoma and Texas areas. Question is whether the Board will consolidate Capital's intermediate route applications.

Because of similar complexities of many other applications in the three big route cases, Washington observers expect hearings to be delayed to fall and ultimate decision to next year.

Counterclaims Fly at Trans-Pacific Hearing

Battle among air giants Pan American, Trans World and Northwest for Civil Aeronautics Board and White House favor in re-apportioning their Orient routes continued last week before CAB examiner Thomas Wrenn.

Here were the main objectives of the contenders:

• **Northwest** wants to keep its northern Pacific route to Japan, and gain extension to India to connect with TWA.

• **TWA** wants to extend its Atlantic-Middle East route from India to Japan to connect with Northwest there.

• **Pan American** wants the right to serve Northwest's North Pacific route from U.S. to Japan because it is 1,600 mi. shorter.

• **Transocean Air Lines** asks a non-subsidy cargo route to the Orient.

▶ **Carriers or Cannibals?**—Northwest president Harold Harris accused Pan American and TWA of attempting "cannibalism" in the Pacific "eating up" their smaller rival.

TWA chairman Warren Lee Pierson accused Northwest and Pan American of neglecting "the national interest factor," which he said "transcends all other issues." He said the U.S. needs a TWA-Northwest 'round-the-world connection competitive with Pan American. But TWA-Northwest must link at Tokyo, not Calcutta, because Japan is the U.S. bulwark in the Pacific.

Pan American vice president Alvin Adams charged that CAB restrictions on PAA routes had "no other reason than to featherbed Northwest Airlines, at a price of millions of dollars to the taxpayer." He said TWA's and Northwest's India-Tokyo ambitions would cost even more millions.

▶ **Major Claims**—To buttress their cases, the carriers made these claims:

• **Costs.** Northwest said its cost per ton-mile in the Pacific is 29 cents, compared to Pan American's 39 cents. Pan American denied this and added that the CAB restriction forcing it to fly 1,600 mi. farther to get to the same place (Japan) accounts for some cost differential, and service to out-of-the-way points in the Pacific and Australasia costs even more.

• **Aircoach.** TWA and Northwest vied to propose lowest 'round-the-world aircoach fares. Pan American proposed aircoach fares to the Orient last year but was turned down by CAB.

• **Equipment.** Northwest said it would give the first nonstop America-Japan service when it gets Wright Turbo Compound-powered Super Constellations. Pan American said it would use coach and first-class Stratocruisers, as it did in inaugurating scheduled West Coast-Hawaii coach service, and would use DC-6Bs for first-class and combination coach-and-cargo flights.

• **Routes.** Northwest said Pan American's South and Central Pacific routes via Honolulu offer a substantial sales advantage because of the warmer climes and more exotic stops. Also, NWA said, natives from warm climates in particular shy from Northwest's chilly Arctic route.

Pan American said it should have the right to jump from its Alaska base to Japan, since the U.S. customer is offered a ticket to the Orient anyway and PanAm should have the privilege of serving by the shortest, cheapest route, without adding any new competition.

TWA said that since it already had rights to China, the fairest adjustment would be to substitute Japan, since Communists took over China preventing TWA from exploiting its rights.

Nonsked Wins Delay Of CAB Hearings

Federal District Court in Washington last week granted North American Airlines a stay of Civil Aeronautics Board enforcement hearings aimed at putting the large nonsked carrier out of business for violating CAB regulations.

North American two weeks ago won a temporary delay of the CAB proceeding in Los Angeles federal court while the contest moved to Washington at the Board's request (AVIATION WEEK July 6, p. 80).

Last week, the district court in Washington heard oral argument between Hardy Maclay, North American attorney, and James Highsaw, representing CAB.

Argument on the preliminary injunction request of the nonsked was slated for this week but may be moved to a later date by a CAB request for more time.

Operators Back C-46 Safety Plan

Consultant says program exceeds CAB requirements, although it fails to meet technical specifications.

A multi-million-dollar C-46 safety program laid out by Ben Howard, test pilot and safety engineer, has won unanimous support from commercial operators of the 150 Curtiss transports in the U.S.

The C-46 Aircraft Engineering Foundation, which engaged Howard as consultant, is going ahead to implement the program.

The foundation was set up by C-46 operators to take the normal place of the plane manufacturer in guiding improved engineering and operation of the aircraft. This was necessary for the C-46 because its original manufacturer, Curtiss-Wright Corp., abandoned the airframe business.

▶ **Realistic Program**—The program will not meet the technical requirements of Civil Aeronautics Board's certification regulation. CAB has ordered compliance with the Civil Air Regulation by the end of this year, but Howard says the new program will make the plane safer than the CAR requires.

He predicts that the planned changes in C-46 parts and operation will make it "safer than any transport but the DC-3."

The C-46 group claims that if Civil Aeronautics Administration and CAB appraise the new alternative program realistically, they will find that it will eliminate or make negligible the risks that led to every one of the C-46 accidents from 1946 to date. Mere compliance with the regulation through adding power would come nowhere near doing that, they argue.

The Board has waived the requirement that DC-3s meet the postwar Civil Air Regulation, because its record is excellent despite noncompliance with the paper standard. The C-46 will be in the same category of reliability and deserve the same exemption when the proposed engineering and operating fixes are made, Howard says.

Signatories to the program are the 40 C-46 operators who belong to the four transport organizations—Air Transport Assn., Transport Air Group, Independent Military Air Transport Assn. and Air Coach Transport Assn.

▶ **Safety Plan**—Here is their program:

• **Rebuilt nacelle.** Redesign of nacelle layout will include the following mechanical improvements:

1. Lower temperatures for cylinder heads and oil. Cowl flaps will definitely be relocated. An oil cooler with greater heat-rejection capacity also may be required.

2. Engine reliability will be improved by the greater cooling and by a new exhaust collector ring, among other items.

3. More power will be obtained from the above improvements—including cooler temperatures and less back pressure from the exhaust system. Howard and the operators are determined not to replace the engine with its more powerful CB-16 version at this time. Capital cost of that would prevent most of the other mechanical and operational improvements, they say, and the result would be less safety instead of more.

4. Fire protection will be gained through installation of a stainless steel firewall between power and accessory section and relocation of cowl flaps.

5. Ground ventilation of engine after shutdown will be improved by an automatic cowlflap system that closes as the engine cools.

• **Prop feathering.** Automatic propeller feathering would not be a safety improvement, Howard says. He calls it an invention to make planes meet the letter of the CAB Civil Air Regulation.

To assure probability that pilots will feather propellers the instant engines lose all useful power, the C-46 program calls for automatic indication of near-zero power. The device would be arranged to prevent feathering of the wrong prop.

• **Wheels-up landing.** There have been five wheels-up landings of commercial C-46s through pilot negligence.

To eliminate this danger, operators will install a simple bar from the full-flap position guard to the wheel position lever. Thus the pilot cannot get full flaps without first lowering his wheels or purposely lifting the bar. It can be shown statistically that chances of forgetting both wheels and flaps are small.

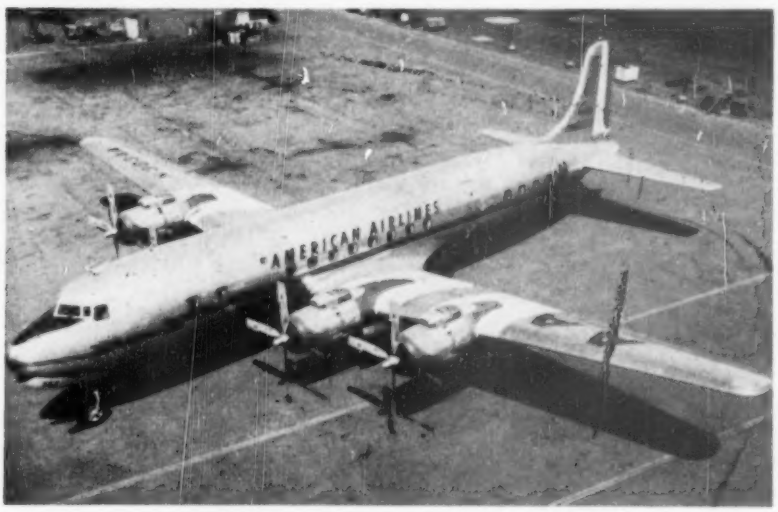
• **Proper flight speed.** A number of C-46 accidents resulted from takeoff or climb with an insufficient margin of speed above stall.

Howard proposes that all C-46s carry a "minimeter"—simple, 50-cent sliding pointer mounted on the airspeed indicator. On its rim are indications of varying gross weights for the C-46s. Sliding the scale to the proper weight moves a set of pointers on the indicator face to indicate proper takeoff, climb and approach speeds.

Stall characteristics of the C-46 are so gentle, Howard says, that pilots do not fear them enough.

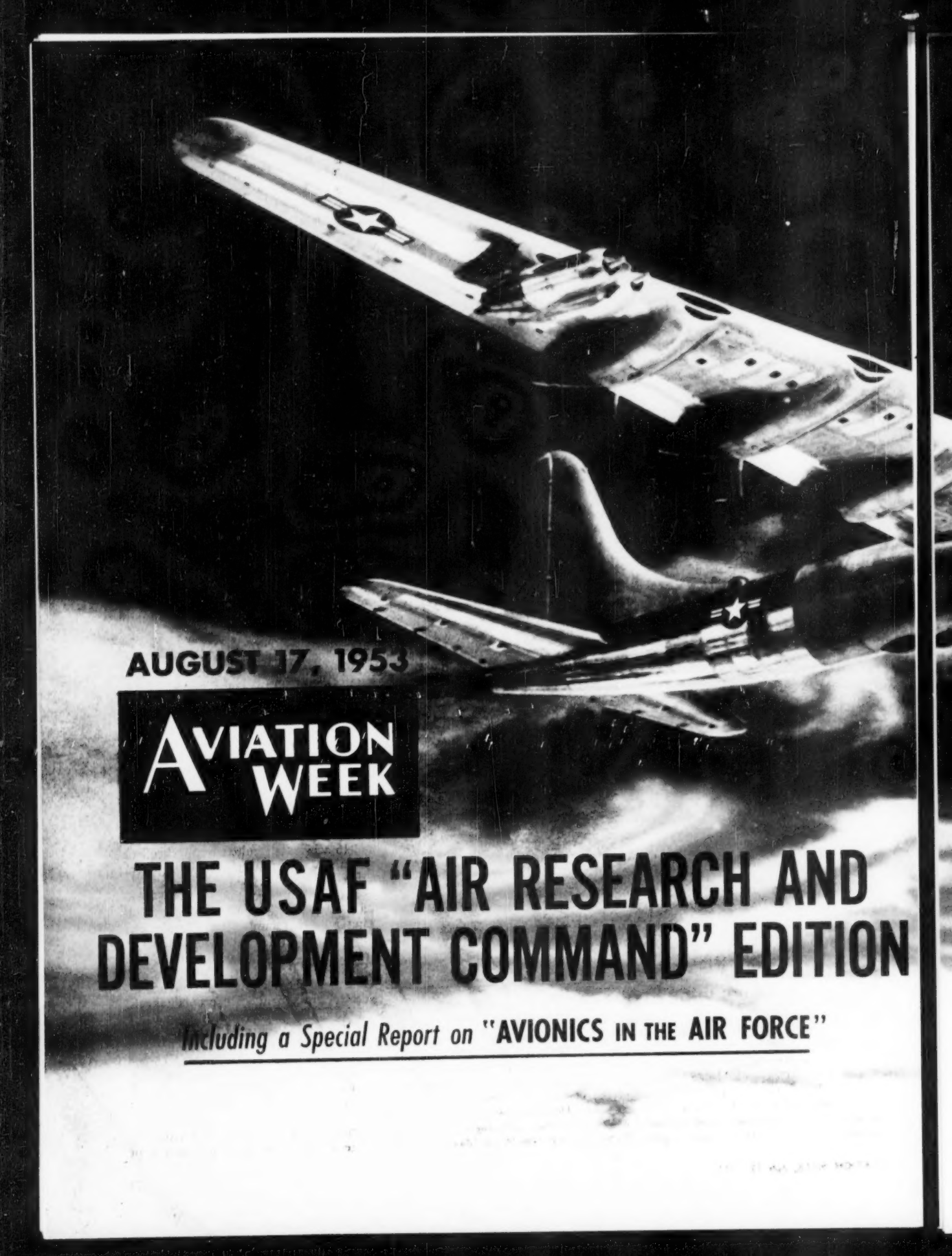
• **Pilot training.** The foundation is laying down a uniform, rigid crew training program for the C-46.

• **Maintenance.** The organization is setting up a full filing and reporting system similar to those normally kept



DOUGLAS DC-7 DONS AA INSIGNIA

First view of Douglas DC-7 shows Wright Turbo Compound-engine transport wearing the markings of American—which will be the first carrier to receive the new airliner. This is the third DC-7 off Douglas' Santa Monica production lines. The first two are being used for flight and certification trials. The fourth will receive progressive modifications indicated by tests. American Airlines gets its first DC-7 in the fall and expects to put the planes into service the end of November. Some modification is expected to make the DC-7 marking on the vertical fin more prominent as part of the airline's promotion of the new aircraft. Photo points up the four-blade Hamilton Standard propellers and new intakes atop each engine (DC-7 first flight story Aviation Week May 25, p. 99).



AUGUST 17, 1953

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by manufacturers to service owners with all the latest information on engineering, maintenance and operation of the type plane. Foundation will:

1. Keep operators up to date on engineering changes and "fixes."
2. Keep minimum standards of plane and aircrew "fitness" among C-46 operators.
3. Act as central office for all C-46 information.
4. Guide and finance C-46 programs for mutual benefit. Individual members are assessed in the manner of any such group undertaking.

▶**Basically Safe**—Howard and some CAB officials maintain that the C-46 design basically is sound and safe. Its simplicity is a major safety asset, as with the DC-3. The transport has a low wing-load ratio, which, when multiplied by the power-load ratio, makes the plane comparable to other types in overall performance, Howard says.

He points to the official CAB cause analyses of all C-46 accidents and says none could be attributed directly to overloaded or underpowered condition. Reducing payload would not make the C-46 safe; the new industry program will, Howard concludes.

MATS Reports Civil Korean Airlift Loads

In the latest roundup of the role of commercial airlines in the Korean airlift, Military Air Transport Service announces that Pan American World Airways and its six subcontracting carriers—Panagra, American, Eastern, Capital, National and Western—made 2,310 Pacific crossings from June 30, 1950, to June 1, 1953.

The PanAm team flew 32,050,029 aircraft miles during a total of 162,900 flight hours, flying 62,775,180 passenger ton-miles, 24,764,082 mail ton-miles, 64,628,398 cargo ton-miles. Number of passengers flown totaled 103,875; 7,962,357 lb. of mail and 20,585,827 lb. of cargo were lifted.

One of the highlights of the combined PAA-subcontractor effort was moving the 31st Fighter-Escort Wing, including spare engines, ground personnel, tools and records from Albany, Ga., to the Far East. The operation was repeated three months later when the 31st was returned to this country and was replaced by the 27th Wing from Texas.

Transocean Air Lines, another major Korean airlift operator, reports that during the 40 months since the war began it has flown 192,749,286 passenger miles, 65,675,917 ton-miles, and 14,656,561 plane-miles in 76,241 flight hours.

These figures cover Travis AFB-Tokyo flights. Using DC-4s that averaged 192 mph. on the run. TAL has been obtaining 12-hr. plane utilization daily.

Wiggins Loses Air Carrier Certificate

Wiggins Airways may lose its subsidy and disappear from the scheduled airline business Aug. 1, following Civil Aeronautics Board decision not to renew the air carrier's certificate.

New CAB member Harmar Denny broke the former Board split on the issue and tipped the scales against Wiggins in the 3-to-2 decision, supporting the previous ruling of Oswald Ryan and Chan Gurney. The majority felt that subsidy paid to the airline was and would remain too high per unit of service and that other local carriers could fill the gap cheaper.

▶**Picking Up the Pieces**—Northeast and Mohawk Airlines will pick up pieces of Wiggins' New England-New York system. NEA gets Fitchburg, Mass., and Woonsocket-Pawtucket, R. I., routes and a one-year authorization to serve Rutland, Vt.

Mohawk will take over the Albany, N. Y.-Boston route via Pittsfield, Springfield and Worcester.

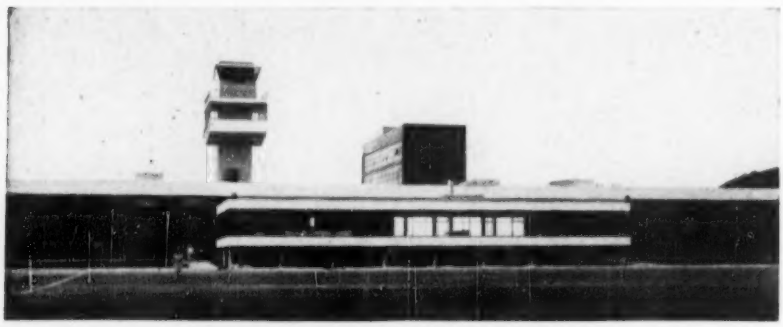
Although Wiggins' subsidy per passenger-mile was highest in the local service industry, its total subsidy was the lowest.

The airline had been maintaining service with lightplanes instead of the DC-3, which is much more expensive per plane-mile but lowers unit cost per passenger-mile with a load.

The Board rejected Wiggins' proposal to streamline its routes and switch to DC-3s. CAB said New England apparently does not require this much additional air service, and the DC-3 would increase subsidy need of Wiggins.

▶**Local DC-3s**—The Board decisions eliminating Wiggins' lightplane and Pioneer Airlines' Martin 2-0-2 service (AVIATION WEEK Mar. 23, p. 73) commit the local airlines to DC-3s almost exclusively for the foreseeable future.

Although local airlines have found that the DC-3 gives the lowest unit costs on local routes, they say it can serve few without subsidy. Local service airlines are getting approximately $20 million of subsidy per year from the Board.



MEXICO CITY'S NEW TERMINAL

A view from the airport at new terminal construction at Mexico City. In the foreground is restaurant affording diners unobstructed view of field's flying activities. The control tower is seen at left, and to right of the tower is five-story structure containing government agency offices. The plane unloading ramps can handle 24 DC-6Bs simultaneously. Ticket accommodations for 20 airlines are available.

CAB ORDERS

(June 24-July 3)

APPROVED:

Avianca, Colombian airline, received International Air Transport Assn. approval to use 57-seat Constellation aircoach for intra-Europe service. Minimum of 59 seats is specified in IATA resolution. CAB approved the waiver but protested Avianca was the ninth air carrier to gain such an exception. "The present tendency would, if continued, result in making the exception to a resolution the rule," CAB said.

Seaboard & Western Airlines was granted permission to make 10 of 12 Europe-New York refugee flights on bids let by Intergovernmental Committee for European Migration. Trans World Airlines submitted bids on two of the 12 flights.

Interlocking control relationships of Pacific Air Freight and Pacific Forwarding Corp. were approved. Similar approval was granted to Gilbert Carrier Corp. and Gilbert Air Transport Corp.

Trans-Texas Airways was authorized to serve Longview-Kilgore-Gladewater, Tex. on flights between Tyler and Lufkin and fly direct Lufkin-Houston on segment 5 flights serving Longview, et al.

International Air Transport Assn. amendment to sales agency rules on refund of agency fees was approved.

West Coast Airlines was permitted to start serving Klamath Falls, Ore. The carrier's mail rates were fixed, retroactive to Aug. 1.

Intercompany agreements of TWA, Air France, et al, were approved.

Transocean Air Lines Oakland-Tokyo flights for national shipping authority were approved because certificated carriers did not bid in accordance with specifications of the invitation.

Capital Airlines gained permission to fly Bell Telephone laboratories technicians for six months while serving as airborne equipment observers.

Airline Assn.'s contract renewal with Defense Department, allowing a 10% discount to military personnel travelling at government expense, was approved again by CAB. Member Josh Lee dissented, as before, on grounds that this was discriminatory in favor of one government agency.

Military Air Transport Assn. was permitted to reorganize as a corporation.

Western Air Freight Forwarders president Ernest Sherry's interlocking relationship as general agent for a motor shippers' association was approved.

DENIED, DISMISSED:

Northwest Airlines was refused permission to suspend service to Kalispell, Mont., on Route 3.

Aircoach Transport Assn. petition for liberalized exemptions of its carriers was dismissed, because ACTA did not follow it up.

Central Pacific Airlines application in the trans-Pacific route case was dismissed at the company's request.

Southwest Airways petition for reconsideration to serve Klamath Falls, Ore. was denied.

CEASE AND DESIST:

Braniff Airways was ordered to stop paying for some professional services with free airline tickets. Braniff consented.

Flying Tiger Line was ordered to cease operating a passenger-carrying nonsked, Associated Airways. The line's certificate restricts it to freight carriage only, except for charters. Company consented.

OTHER:

CAB proposes to eliminate Provincetown, Mass., from Northeast Airlines' route, because NEA cannot serve the city with its present planes. Elimination of Northeast's inactive franchise is a necessary legal step to clear the way for Post Office to let a "star" carrier route to Provincetown-Boston Airline, an air taxi operator.

North American Airlines petition for dismissal of enforcement proceeding was deferred by the Board, which alleges that some evidence in the case indicates violations not only of CAB regulations but also of the Civil Aeronautics Act.

American Airlines application to serve Niagara Falls, N. Y., through use of Buffalo Municipal Airport was scheduled for public hearing.

Universal Air Freight Corp. application for a letter of registration will be investigated to find if the company's rail and truck affiliations are permitted by the Civil Aeronautics Act.

Western Airways request for permission to suspend service to Spearfish, S. D., or serve it via the Rapid City Airport will be investigated.

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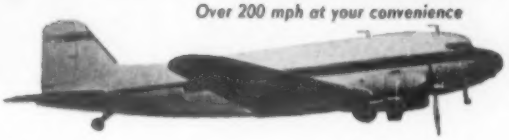

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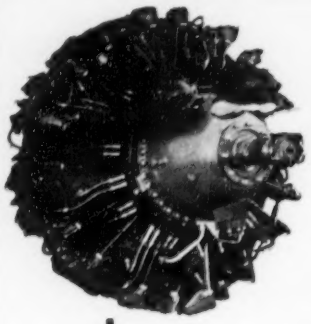

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47	2-1046-76	Parker	Valve (3000 PSI)
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68	SP4-2746-77	Parker	Restrictor Valve
105	SP4-2746-78	Parker	Restrictor Valve
68	6-746-10	Parker	Valve
40	SP4-2746-79	Parker	Restrictor Valve
48	SP-2746-80	Parker	Restrictor Valve
60	SP4-2746-81	Parker	Restrictor Valve
127	PL2-2546-75	Parker	Cone Check Valve
123	PI2-2546-76	Parker	Cone Check Valve
620	PL2-2546-77	Parker	Cone Check Valve
540	PL2-2546-78	Parker	Cone Check Valve
142	SP4-2746-76	Parker	Restrictor Valve
112	PLY-843-54	Parker	Check Valve
23	PL2-1846-77	Parker	Check Valve
120	MF9-713-15A	Vickers	Hydraulic Pump
124	PF12-713-25BCE	Vickers	Hydraulic Pump
10	PF9-2713-20Z2	Vickers	Hydraulic Pump
327	PF4-713-20BCE	Vickers	Hydraulic Pump
57	MF45-1911-20Z	Vickers	Hydraulic Pump (3000 PSI)
28	AA31400	Vickers	Valve
125	D7818	Adel	Anti-Icer Pump
250	AN4014	Erie Meter	Wobble (D-3) Pump
45	AN4103-2	Clifford	Brass (Valve #U4785) Oil Cooler
70	AN3213-1	Scintilla	Ignition Switch
250	A-9 (94-3226)	Nesco	Ignition Switch
66	M862A	Jos. Pollack	Master Switch
148	PG208AS1	Honeywell	Switch Air Ram.
40	PG208AS7	Honeywell	Air Ram Switch
18	4582-AA-6C	Dynamic Air Eng.	Blower
24	U-702-15	Joy Mfg. Co.	Blower
20	V301B7	Aerotec	Pressure Relief Valve
419	450	Skinner	Filter
287	1033-4E1	White-Rodgers	Heater Control Switch
126	17322-2	Fenwall	Thermo Switch
34	9804B	Vapor Car Heating Co.	Control Box
25	46B311	Vapor Car Heating Co.	Compensator
202	A812	Interstate Aircraft & Eng. Co.	Solenoid
46	146102	Bendix	Valve (0-500 PSI)
240	1265-900	Airex	Relief Valve
29	HC2109	Air Associates	Hyd. Cylinder
8	HC2110	Air Associates	Hyd. Cylinder
53	AN6203-3	Bendix	Accumulator 10"-1500 P.S.I.
90	JH950-R	Jack & Heinz	Starter Motor
140	K14949E	Marquette	Windshield Wiper Kit
188	EYLC-2314	Barber-Coleman	Control
230	921-B	Stewart-Warner	Heater (200000 BTU)
22	0655-D	Aro	Oxygen Regulator
65	ASDC2	CO2 Mfg. Co.	Fire Detector
97	6041-H-146A	Cutler Hammer	Relay (B-12)
237	6141-H69A	Cutler Hammer	Circuit Breaker
47	7964-404	Leach	Relay
22	M-2031	Air Associates	Actuator
11	FYLD2516	Barber-Coleman	Thermostat
51	AYLZ2284	Barber-Coleman	Micropositioner
20	72400	Ham. Stand.	Prop. Reversing Control
10	5X18	Woodward	Governor
46	A14-A-9708P	Westinghouse	Contractor
26	70G3	G.E.	Transformer
718	B9A	Square D	Relay
6	83A9	Surface Combustion Co.	Heater
115	C6363-1-5A	Spencer	Circuit Breaker
115	C6363-1-2A	Spencer	Circuit Breaker
33	18784	Adel	Restrictor Valve
1700	AM1614-80	Heinemann	Circuit Breaker
31	EOBX-2	Allied	Relay
85	12994-2	Adel	Lock Valve
805	58G926	G.E.	Ballast Core & Coil
140	58G946	G.E.	Ballast
40	7210-24	Leach	Relay
66	25432	Airesearch	Flex. Cable
518	MT48C	Bendix Radio	Insulator
20	M-101-B	Aerotec	Pressure Switch
12	MT68EG	Bendix Radio	Mount
52	715E	Fulton Syphon	Temp. Control
478	D9530	Adel	Selector Valve
668	D9530-2	Adel	Selector Valve
498	D9560-2	Adel	Selector Valve
179	D9632	Adel	Selector Valve
237	D9696	Adel	Selector Valve
744	D10044	Adel	Selector Valve
244	D10051	Adel	Selector Valve
814	74947 (TY, PH3)	Aero Supply	Valve
335	AN5830-1	Whittaker	Valve
74	AN5830-6	Whittaker	Valve
60	AN5831-1	Parker	Valve
130	612-4A	Eclipse	Valve
2200	37D6210 (AN4078-1)	United	Solenoid Valve
1888	K1593-6D	Kohler	Valve
500	NF3-5	Mallory	Noise Filter
20	TA-12B	Bendix Radio	Transmitter
35	RA10-DB	Bendix Radio	Receiver
2585	AN3096-4	Grimes	Dome Light
775	AN3096-5	Grimes	Dome Light
1365	AN3096-6	Grimes	Dome Light
6	610-2C	Eclipse	Vacuum Pump
550	PD12K10	Stromberg	Carburetor
236	PR48-A1	Stromberg	Carburetor
90	1685-HAR	Holley	Carburetor
19	1375F	Holley	Carburetor
407	SF9-LN-2	Scintilla	Magneto
185000	LS4-AD1	Aero	Spark Plug
1	R1820-52	Wright	Engine
16	R1820-54	Wright	Engine
4	R1820-60	Wright	Engine
1	R1830-43	P & W	Engine
166	1045A	P & W	Bearing
500	3506	P & W	Flange
130	8288	P & W	Follower Ass'y.
814	35814	P & W	Blower Ass'y.
53	48362	P & W	Shaft
75	48363	P & W	Shaft
56	48392	P & W	Sump
390	48461	P & W	Gear
78	76236	P & W	Gear
1178	84289	P & W	Bearing
113	84487	P & W	Housing
77	84591C	P & W	Nose Housing
200	48350-D	P & W	Crankcase Ass'y.
200	84083	P & W	Cylinder
100	84084	P & W	Cylinder
200	84085	P & W	Cylinder
281	CR2791-G100-K4	G.E.	Relay
626	CR2792F101-A3	G.E.	Relay
41	G34464	Guardian	Relay
350	G31502-A	Guardian	Relay
22	146102	Vickers	Brake Valve
9	557-5	Eclipse	Check Valve
107	D12296	Adel	Pump
67	19100-2-101B	Kenyon	Check Valve
88	3135-11C	Eclipse	Pressure Switch
32	3V-217-HC	Pesco	Separator
100	27314	Purolator	Oil Filter
128	3801-3D	Eclipse	Fuel Quan. Gauge
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740	1C-200	G.E.	Radio Noise Filter
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4	2CM46A2	G.E.	Generator
6	2P248EB	Pesco	Fuel Pump
21	2E2585A	Pesco	Pump
146	AW2-3/4-95K	U.S. Gauge	Manifold Press Gauge (Metric)
27363	CREB3N	Casco	Rod End
18	SA/3A	Kidd	Impact Switch
13	3GBD1A18A	G.E.	Regulator
18273	AN200-K3L2	Fafnir	Bearing
245	LMR-4	Micro	Switch
2094	PM-5	Spencer	Circuit Breaker
44	5BA25D-J4B	G.E.	Motor
31	5AM31JJ9A	G.E.	Amplidyne
111	5AM31NJ10	G.E.	Amplidyne
425	5BA40NJ1A	G.E.	Motor
189	5PD65-MB1	G.E.	Motor
25790	NR6L12	Torrington	Bearing
26	MS49A	Bendix Radio	Antenna Switch
45	D2060	C. P. Clare	Relay
298	727-TY37P	Weston	Air Temp. Ind.
2000	8909-K99	C. H.	Switch
2747	NAF310310-4B	Cannon	Plug
402	NAF310310-5B	Cannon	Plug
132	AN6209-8	Hydro Aire	Valve
50	AN6213-2	Bendix	Hyd. Valve
280	AN6220-4	Aeroquip	Couplings
27	AN6247-2	Adel	Hyd. Valve
14	UA8013-MM	United Aircraft Prod.	Oil Cooler
1175	RS-2	Mallory	Selector Box
172	A7012	Delco	Motor
6	8DJ13ABK	G.E.	Tachometer Indicator
200	2222-1F-2A	Eclipse	Tachometer Indicator
28	AN5770-2	Manning Maxwell Moore	Manifold Pressure Gauge
71	1003-4	Eclipse	Generator
427	NAF1016-1	Adams & Westlake	Light Ass'y.
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1008	1222BF	Leach	Relay
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SHORTLINES

► **Air Line Pilots Assn.** (AFL) has rented out (for $25,000 a year) the third floor of the "House That Behncke Built," elaborate ALPA Headquarters Building in Chicago. The union will continue to occupy first and second floors of the building.

► **Air Transport Assn.'s** vice president-operations, Milton Arnold, has testified against a congressional bill to sell the land acquired for Burke Airport in Washington. Washington's need for a second airline airport has reached crisis proportions, he said, and plans for Andrews Field still are uncertain. It would be wasteful and even dangerous to sell Burke before Andrews is assured, Arnold concluded.

► **German Lufthansa** has ordered Lockheed Super Constellations, powered by Wright Turbo Compound engines, and Convair 340s for overseas and European routes when the pre-war international airline resumes operations. Number of U.S. piston-powered transports purchased for Lufthansa's initial buildup was not revealed, but sources have indicated the line will revive operations with approximately 24 planes (AVIATION WEEK May 11, p. 100). Delivery is expected in the summer of 1955 after German civil aviation is given a green light by ratification of the Allied peace treaty.

► **Flying Tiger Line** reports January-June commercial airfreight revenues gained 14% from 1952 to $3,263,900.

► **International Civil Aviation Organization** soon will include Japan and Nationalist China (Formosa) as members.

► **Lockheed Aircraft Service** converted 27 Constellations and DC-6s to air-coach seating in the last 12 months. LAS was first to convert TWA Connies and American DC-6s and has more American DC-6s in modification now.

► **North Central Airlines** reports June was its record month with 23,712 revenue passengers carried, a 65% gain from a year ago.

► **Northwest Orient Airlines** carried a record 104,600 passengers during June, topping the previous monthly high of 92,216.

► **Overseas National Airways** is converting its DC-4s (on lease from Air Force) to "E"-type fuel systems transferring long-range fuel tanks from fuselage to wings, adding an extra 400 cu. ft. cargo space to the cabin. Pacific Airmotive delivered the first conversion job, second is in process.

► **Sabena Belgian Airlines** started DC-6 service Brussels-Elizabethville, Belgian Congo.

► **Southwestern Local Air Service Conference** plans to become a vital influence on Civil Aeronautics Board route and mail rate cases. Pending route-renewal fights cited by the conference include Trans-Texas next March and Pioneer the following September. The group is backing a resolution before the U. S. House Rules Committee to investigate local air service, including CAB's policy of granting temporary certificates only to such lines.

► **Trans World Airlines** withdrew its Buffalo-Rochester-Syracuse route application from the New York-Chicago route case (see p. 83), stating that this was "adhering to a policy of advocating new route extensions only when they are justified by actual requirements of public convenience and necessity."

► **United Air Lines** sold Hubbard Field, Reno, to the city for $900,000, contingent on federal aid.

Fast Climbs

Tests of a new technique to get transports to altitude more quickly and reduce noise nuisance have been extended to the DC-6B. Flights with an American Airlines' -6B at New York International Airport (Idlewild) appear to confirm earlier findings of tests at Newark Airport with an Eastern Air Lines' Constellation.

The new system, worked out jointly by the Air Line Pilots Assn. and the Air Transport Assn., seeks to obtain steeper climb gradients by using:

- **Lesser rates of acceleration.**
- **Lower airspeeds.**
- **Higer power settings.**
- **Wing flap management** consistent with these conditions.

Observers say that with the new technique planes reach a given altitude in half the distance usually required. This is supported by study of photographic records made by a Fairchild flight analyzer camera.

The program, being conducted under auspices of the National Air Transport Coordinating Committee, will probably be continued in the New York area.

AVIATION CALENDAR

July 15-16—IAS Annual Summer Meeting, Honors Dinner, IAS Building, Los Angeles, Calif.

July 18-19—Air review commemorating 50th anniversary of powered flight and 25th anniversary of Eastern Air Lines, Akron-Canton (Ohio) Airport.

July 27-Aug. 2—1953 model airplane championship, U. S. Naval Air Station, Willow Grove, Pa.

Aug. 2—Amarillo, Tex., Jaycee Air Fair, observance of 50th anniversary of powered flight, Tradewind Airport.

Aug. 3-8—Fourth annual congress, International Astronautical Federation, Zurich.

Aug. 19-21—Western Electronic Show and Convention, San Francisco.

Aug. 19-24—Seventh International Model Plane Contest, sponsored by Plymouth Motor Corp., at Selfridge AFB and Belle Isle, Detroit.

Aug. 25—Ninth legal committee session, International Civil Aviation Organization, Rio de Janeiro. Meeting will study and revise a draft intended to replace or amend the Warsaw Convention international air law.

Sept. 5-7—National Aircraft Show and 50th anniversary of powered flight, Dayton (Ohio) Municipal Airport.

Sept. 7-13—1953 SBAC Coronation Year Flying Display, Farnborough, Hampshire.

Sept. 7-17—Fourth International Aeronautical Conference, joint meeting of RAeS and IAS, London.

Sept. 9-11—Air safety seminar of Flight Safety Foundation. Probable location: Luxembourg.

Sept. 12-13—Third Wisconsin air pageant, Curtiss-Wright Airport, Milwaukee.

Sept. 21-25—Eighth National Instrument Exhibit, Instrument Society of America, Sherman Hotel, Chicago.

Sept. 23-24—1953 meeting of Aircraft Spark Plug and Ignition Conference, Champion Spark Plug Co., Toledo.

Sept. 28-30—Ninth annual meeting, National Electronics Conference, Hotel Sherman, Chicago.

Sept. 29-Oct. 3—National Aeronautics Meeting, Aircraft Engineering Display and Aircraft Production Forum of the Society of Automotive Engineers, Hotel Statler, Los Angeles.

Sept. 30-Oct. 1—Aircraft electric equipment conference, American Institute of Electrical Engineers, Seattle.

Oct. 10—England-Christchurch (New Zealand) air race, with speed and transport handicap sections.

Oct. 10-17—Fifth annual all-Texas air tour, sponsored by Texas Aeronautics Commission, Austin.

Oct. 14-15—Annual airport development and operation conference, sponsored by New York Department of Commerce, Onondaga Hotel, Syracuse, N. Y.

Oct. 28-30—Annual convention of Southeastern Airport Managers' Assn., Marlin Beach Hotel, Ft. Lauderdale, Fla.

Nov. 16-17—Aircraft Quality Control Conference of the Aircraft Technical Committee, American Society for Quality Control, Biltmore Hotel, Dayton, Ohio.

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AEROPRODUCTS DIV., G. M. C 37
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AEROTEC CORPORATION, THE 36
Agency—Heuing & Co., Inc.
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ALLEGHENY LUDLUM STEEL CORP 62
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CONSOLIDATED VULTEE AIRCRAFT CORP 19
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Agency—Fuller & Smith & Ross, Inc.
HANSEN MFG. CO 76
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HARPER COMPANY, H. M. 33
Agency—The Buchen Company
HAYDON MFG. CO., INC 22
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ROBINSON CO., RALPH C 47
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ROMEC PUMP DIV., LEAR, INC 81
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SEARCHLIGHT SECTION 89, 90, 91, 92, 93, 94, 95
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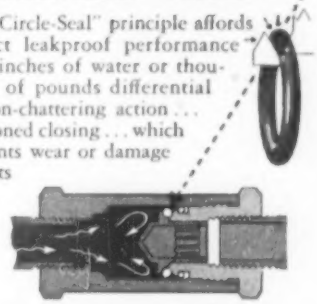

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LETTERS

Those AF Pilots

At the risk of overworking the thing, I'd like to say a few words on the very interesting controversy stirred up by Capt. Robson's views of USAF accidents.

First of all, everyone has apparently accepted the thesis that the Air Force has large numbers of pilots with 10,000 hours and up sitting behind desks. Of my flying experience with MATS, I must state this is absolutely not so.

By the time an aircraft commander reaches the 5,000-6,000-hr. bracket, he's due for his majority and an administrative or operations-type job. Then he starts logging 100-300 hr. a year to meet his pay and yearly flying requirements.

This is inevitable and necessary for there must be experience in the administrative jobs as well as on the flight line.

And no one could expect an AF transport commander—usually a first lieutenant or captain—to stay in a strictly flying job which is a dead-end street as far as promotions go. (And can you blame him for being a little bitter when he sees his civilan counterpart drawing more than twice his salary and flying considerably less.)

In that last sentence, then, we may have a clue as to why the AF doesn't have lots of high-hour men. Relatively low pay for an admittedly highly skilled job. Senator Douglas wants to cut flight pay!

However, it is my contention that hours alone do not make the good pilot. It helps. And I feel certain that the record compiled by Troop Carrier and MATS pilots in the 2,000-6,000-hr. bracket is quite as good as the high-time scheduled airlines' pilot. I have no qualms about entrusting my life to either civilian airlines or these two airline-type military operations.

The airline-type operations of the AF are not an "inadequate attempt" as Capt. Robson says, nor are their pilots, "boys doing a man's work" as Capt. Kuhn implies. That's hitting below the belt, gentlemen, and makes your statements that we in the military can fly, a bit raw.

It's unfortunate that the USAF ran into that string of accidents last year which prompted Capt. Robson's original column. But the civilian airlines have had equally tough luck and it never occurred to me that it was anything but the run of accidents—inevitable as long as we fly planes or drive cars or ride trains—averaging out.

I guess what I'm trying to get across is that the civilian airline pilot—and his system—are top notch. But so are the military airline-type pilot—and his system. If I were near the USAF flying safety headquarters, I'd try to get some facts to bear this out. For Capt. Robson, myself, and everyone involved has so far relied on a lot of talk and a few isolated incidents.

As long as planes fly, I figure that some of them will be crashing. Our aim is naturally to cut the averaging-out I mentioned earlier, down to as close to nothing as possible. And, in addition to pilots, that puts the ball right into the hands of those of your readers who have perfected the planes and devices which have made flying as safe as it is today.

I can strive to be a proficient pilot but the odds grow short if a couple of engines quit on takeoff. Granted most accidents are attributed to pilot error, it's quite probable there are devices possible that would make that error on the part of the pilot a lot less likely to happen. And, Mr. Manufacturer, that guy in the left seat of an American Airlines' DC-6 needs it just as bad as the MATS or Troop Carrier pilot because he and his system aren't a bit better, I'm convinced.

Maybe because mail delivery is sometimes a bit slow in these parts of the world, I can at least get the last printed word in this argument.

2nd Lt. Robert B. Downs
Navy 230, c/o Postmaster
Seattle, Wash.

USAF & Cochran

Just as a matter of curiosity: How does the USAF justify the large sum of money they are spending on Jacqueline Cochran so that she can fly 700 mph? T-33 trainers, Sabres, maintenance, fuel, manpower, etc., all cost money and lots of it.

Human beings have traveled much faster than 700 mph., so what is the object of the operation? Going faster than Jacqueline Auriol's 508.393 mph. only proves that the F-86E is faster than a 1951 de Havilland Vampire.

I am not trying to detract from Miss Cochran's many worthy accomplishments and hope she achieves her objective. My purpose is to find out why the USAF is footing the bill for a project that doesn't seem to have an objective that is benefiting the taxpayer who shovels the money out.

The Air Force must have thousands of jet pilots who would like nothing better than to break the world's speed record. Why aren't they used if the project is so important?

As an ex-fighter pilot and one who has been flying with the reserve since the end of World War II, I can think of nothing I would rather do than fly a jet. Not breaking any records—just fly one.

Hope you can shed some light on this matter. Thank you for your help.

Daniel B. Scully

(Aviation Week asked spokesmen at the Pentagon the questions contained in the letter above. The reply was that USAF is "embarrassed," and that permission came from "high up." They pointed out that Miss Cochran flew in a Canadair F-86, but concede she was checked out in an Air Force T-33 and that day-to-day flight testing programs at Edwards AFB were disrupted while she hung up the records.—Ed.)

Low-Frequency DF

Thank you for the fine article by Scott Reiniger which you published May 4 about Gavco's low-frequency direction finder.

During our studies of air navigation problems we at Gavco have seen a very definite change of feeling in recent months among high aviation officials regarding low-frequency equipment. Whereas in the past few years the prevailing opinion was that high-frequency navigation devices were going to solve all problems—there has been a definite change of heart with the realization that it's doubtful that one system could ever solve all of the flight situations that exist today.

The overseas operations of international air carriers are the most obvious case in point. We can never hope to pay for all of the high-frequency beacons needed to make such systems as VOR (visual omnirange) worldwide. Or take the case of our present ILS landing systems—pilots cannot (and do not) depend on the high-frequency fan markers which must tell them their position in the glide path—mainly because there is no aural signal.

As a result, it is standard procedure for all airline pilots to use the low-frequency compass locaters (which are mounted in the same relative position as the fan markers) to definitely orient their position on the glide path with respect to distance from the field. And there are many other similar situations to be found.

We at Gavco want to invite any and all people who think that low-frequency equipment is "passe" to a flight test of our twin-loop system. They will find that Gavco's ADF will provide satisfactory homing in the face of severe static conditions. We think that our system is of tremendous importance to the aviation industry and are doing all in our power to make it available on a production basis.

Our engineers must have misfired when they told your reporter that the range is 100 to 1,000 kc.—the system actually operates between 190 and 1,750 kc.

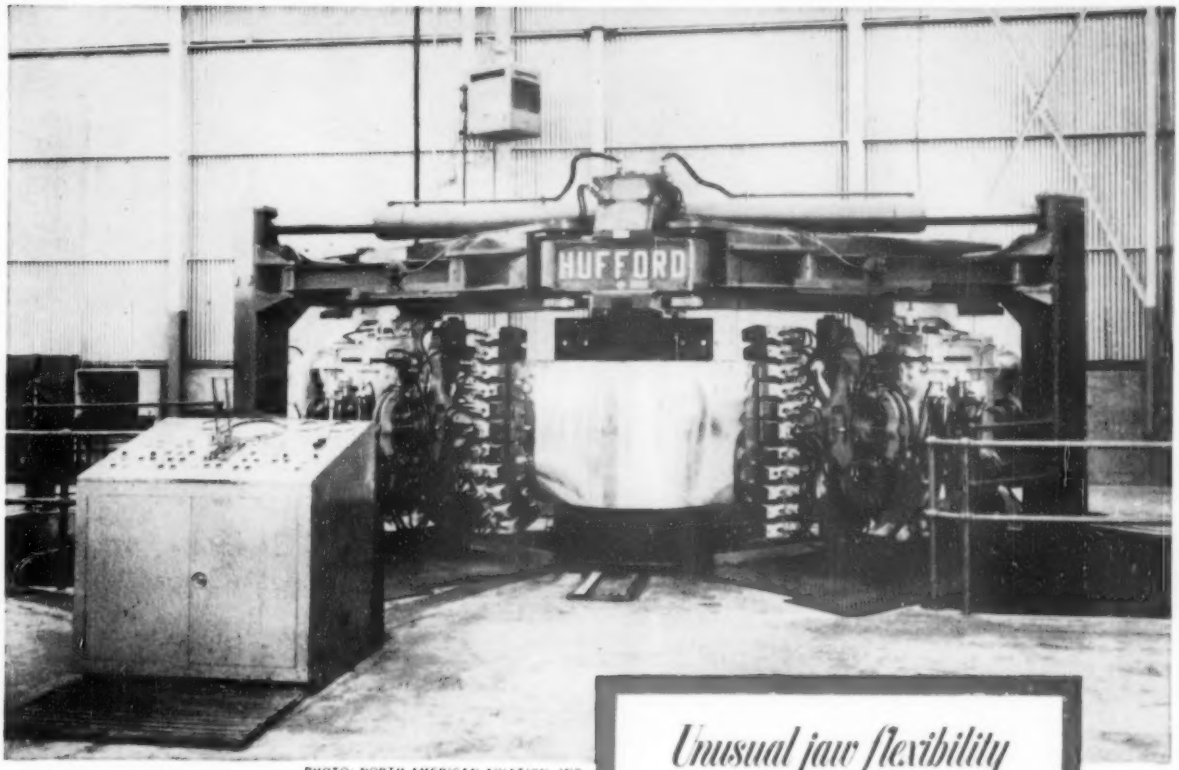
Roy McGiffin, President
Gavco Corp.
540 E. 80th St.
New York 21, N. Y.

Who's Blind?

In regard to a letter by a William E. Irving, airline co-pilot, in your Apr. 20 issue ("Who's Blind?"), I was wondering if Mr. Irving could supply any information on how much the "less-than-5,000-hour" co-pilots fly our airliners. Perhaps Mr. Irving should peer into the cockpit of a well-equipped and fully instrumented lightplane. We even have flaps now!! Some of us even fly instruments!!

Mr. Irving closes his dissertation by remarking, "I'll see you in the control area." I doubt it. I doubt if he'll see anything smaller than a DC-6.

Richard E. Hollingshead
2607 Chester Road, N.
Columbus, O.



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Hufford HYDRA-CURVE Jaws *are available for all Hufford machines and can be used on other types of stretch presses. Ask for the HYDRA-CURVE folder—it tells the complete story!*

Unusual jaw flexibility improves part formation three ways!

HYDRA-CURVE Jaws reduce transitional area stresses by matching the sheet to the cross sectional die curve, thus eliminating failures.

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HYDRA-CURVE Jaws permit formation of deep curves heretofore impractical or impossible by the stretch-forming process.

Photos illustrate a few of the many possible jaw curvatures. These contours may all be reproduced in reverse positions as well as those shown.

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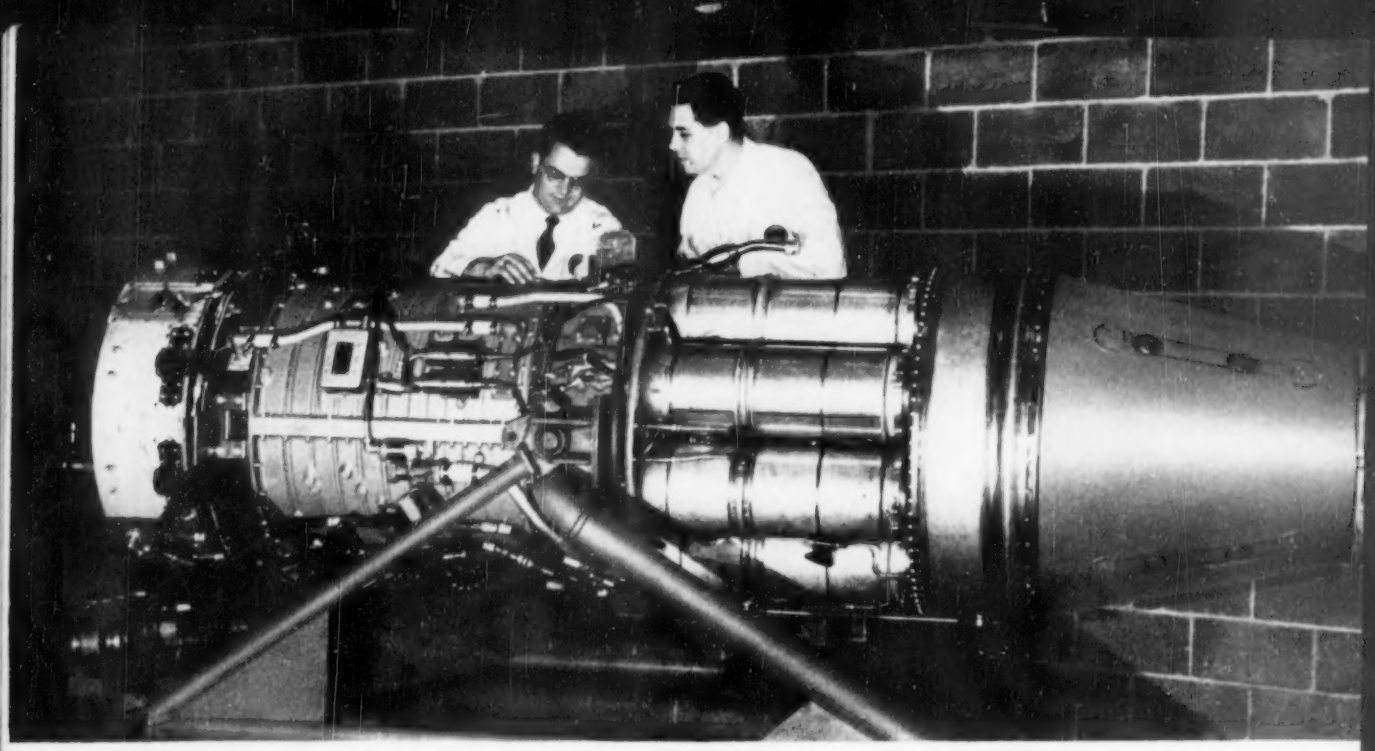

G-E Development Program Will Save USAF $100,000,000 On B-47 Powerplants

Engine Improvements Double Service Life Between Overhauls of J47-25

Directing some of its best engineering efforts at making a good engine even better, General Electric has succeeded in doubling the life expectancy between overhauls of the J47-25 engine, powerplant of the famous Boeing B-47 Stratojet.

This extended life is the direct result of a continuing program at General Electric to improve the performance of production engines while designing more powerful, lighter-weight, more efficient engines for the future. Does it pay off? G-E engine improvements, coupled with the Air Force's quality control and field maintenance program, will save U.S. taxpayers $100,000,000 a year on the -25 engine alone!

Actually General Electric's engine improvement and development program has resulted in over 3000 improvements in the J47 engine—ranging in scope from a minor change in fasteners to a major change in combustion chambers.

But engine improvements alone are not enough at G.E. First and largest manufacturer of jet engines in the U.S., General Electric is also continually improving manufacturing processes. Vertical assembly is a good example: it saves space, speeds assembly, assures optimum alignment of engine parts.

Such improvements are the basis for the statement, "Progress is our most important product." *Section 230-18, General Electric Company, Schenectady 5, N.Y.*

POWERED BY SIX G-E J47-25 engines, the Boeing B-47 Stratojet can now fly twice as many hours between engine overhauls . . . a direct result of G.E.'s engine improvement and development program and the USAF's quality control and field maintenance program.

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